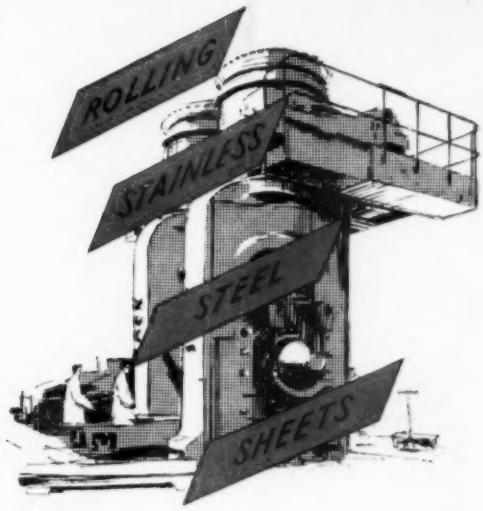
Sheet Metal Industries

The only Journal in the World wholly devoted to the Manufacture, Manipulation, Fabrication, Welding, Assembly and Finishing of Ferrous and Non-Ferrous Sheet and Strip

VOL. 37 : No. 400 AUGUST 1960 PRICE 2/6



20 years ago this 4-high mill at the Stocksbridge Works of Samuel Fox and Company Limited was equipped with Timken bearings of 48 inches o.d. on the back-up rolls.

Recently the mill has been reconstructed with a roll length of 82 inches to roll 6 ft. wide sheets.

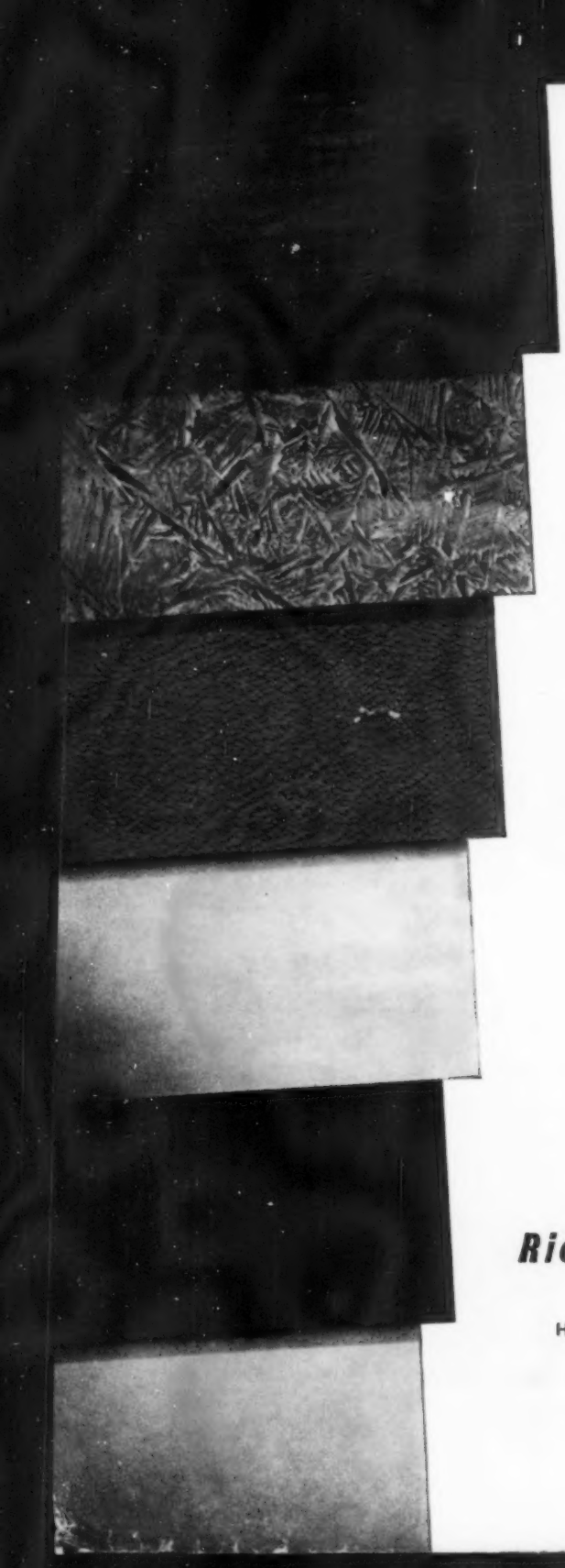
The original Timken bearings were still in such excellent condition that they have been used in the reconstructed mill.

British Timken, Duston, Northampton, Division of The Timken Roller Bearing Company. Timken bearings manufactured in England, Australia, Brazil, Canada, France and U.S.A.

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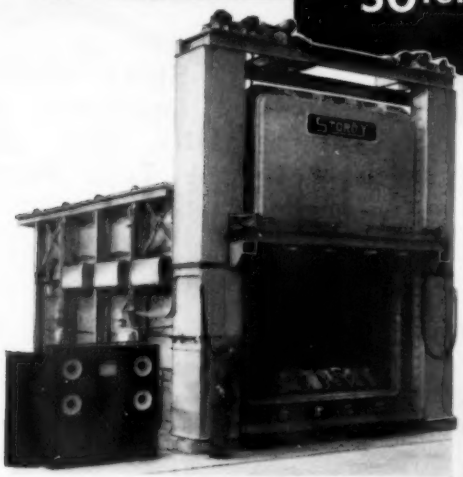
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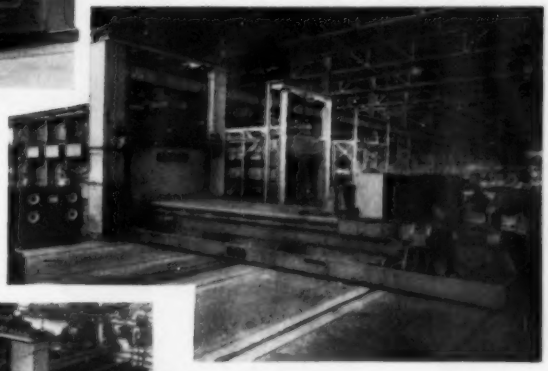
STORDY

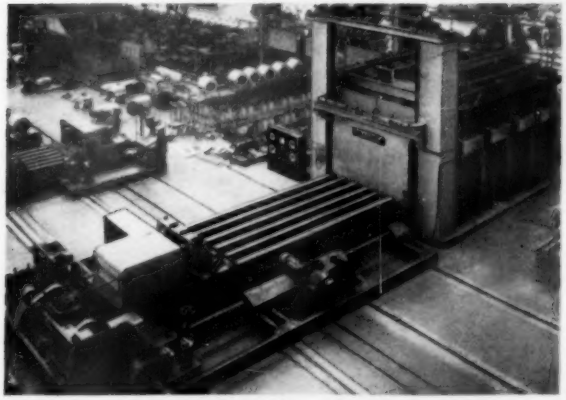
light alloy atmosphere annealing plant with 50ton charging machine



This plant is a further example of Stordy experience in the field of light alloy heat treatment—it comprises three batch-type electrically heated furnaces, a 50-ton charging machine, loading and unloading racks and inert gas plant.

The 50-ton charging machine is fully mechanised with power operated, long travel racking and lifting motions. The heater batteries and circulating fans of the furnaces are designed for ease of removal for maintenance and a minimum of refractory is used in the construction.



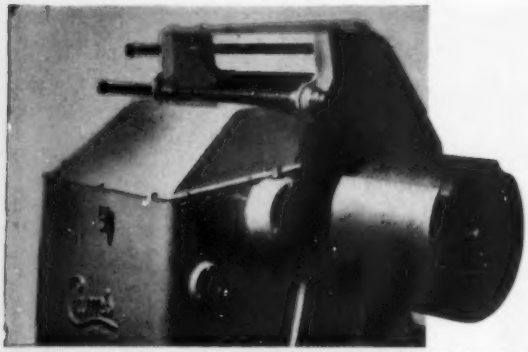


Design staff, full manufacturing facilities, technical and service engineers in the field combine to provide a complete organisation for the design and manufacture of heat treatment equipment—batch and continuous furnaces, furnace atmosphere plant, handling gear including heavy duty charging machines, material handling systems, conveyors and ancillary equipment.

Photographs are reproduced by courtesy of Reynold T.I. Aluminium Ltd.

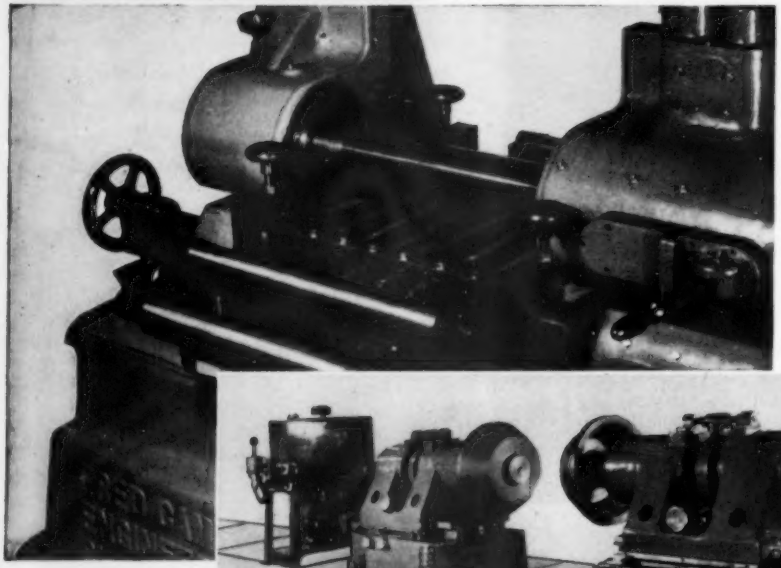
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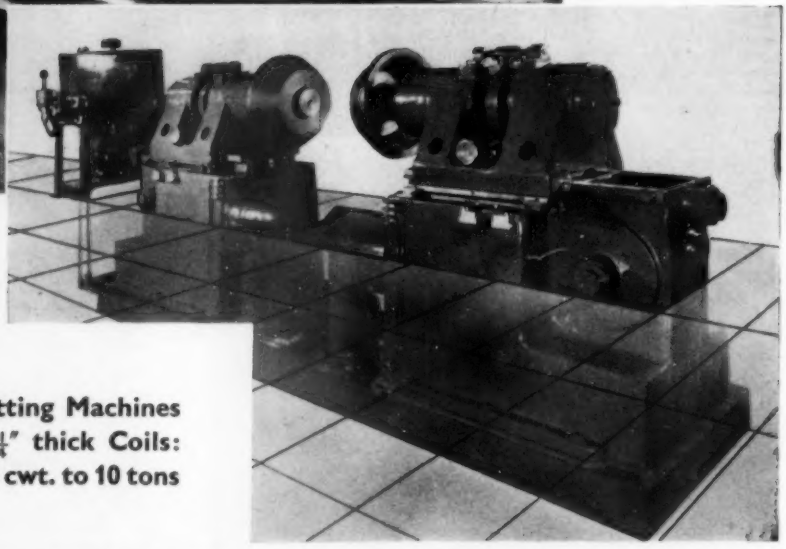
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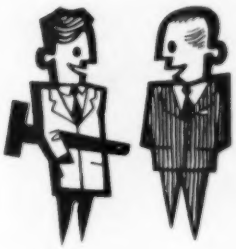
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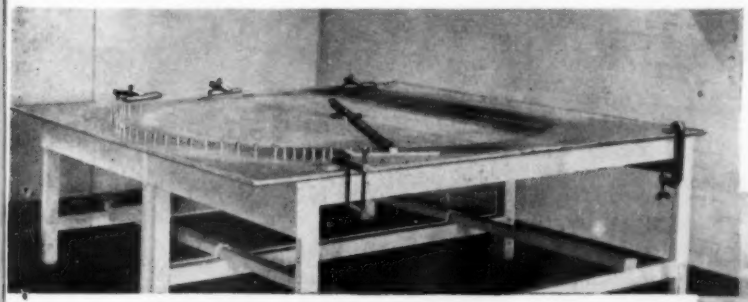
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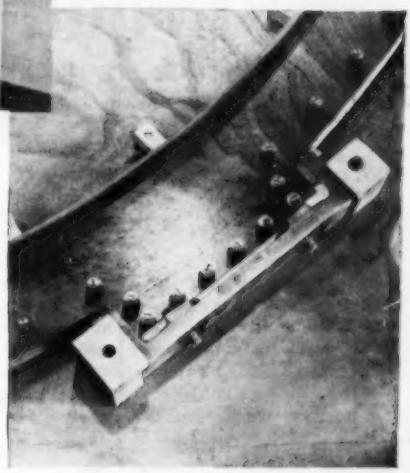
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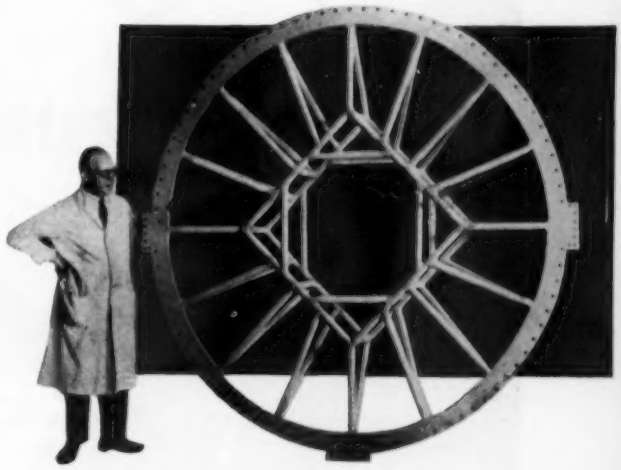
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The illustrations show some of the stages of fabrication. A drill bush location plate is spigoted to the prepared working surface-bushes and metal inserts are positioned and fixed with wood screws and the 'dam' is built up—after fabricating the main ring the final step is to cement in the structural members.



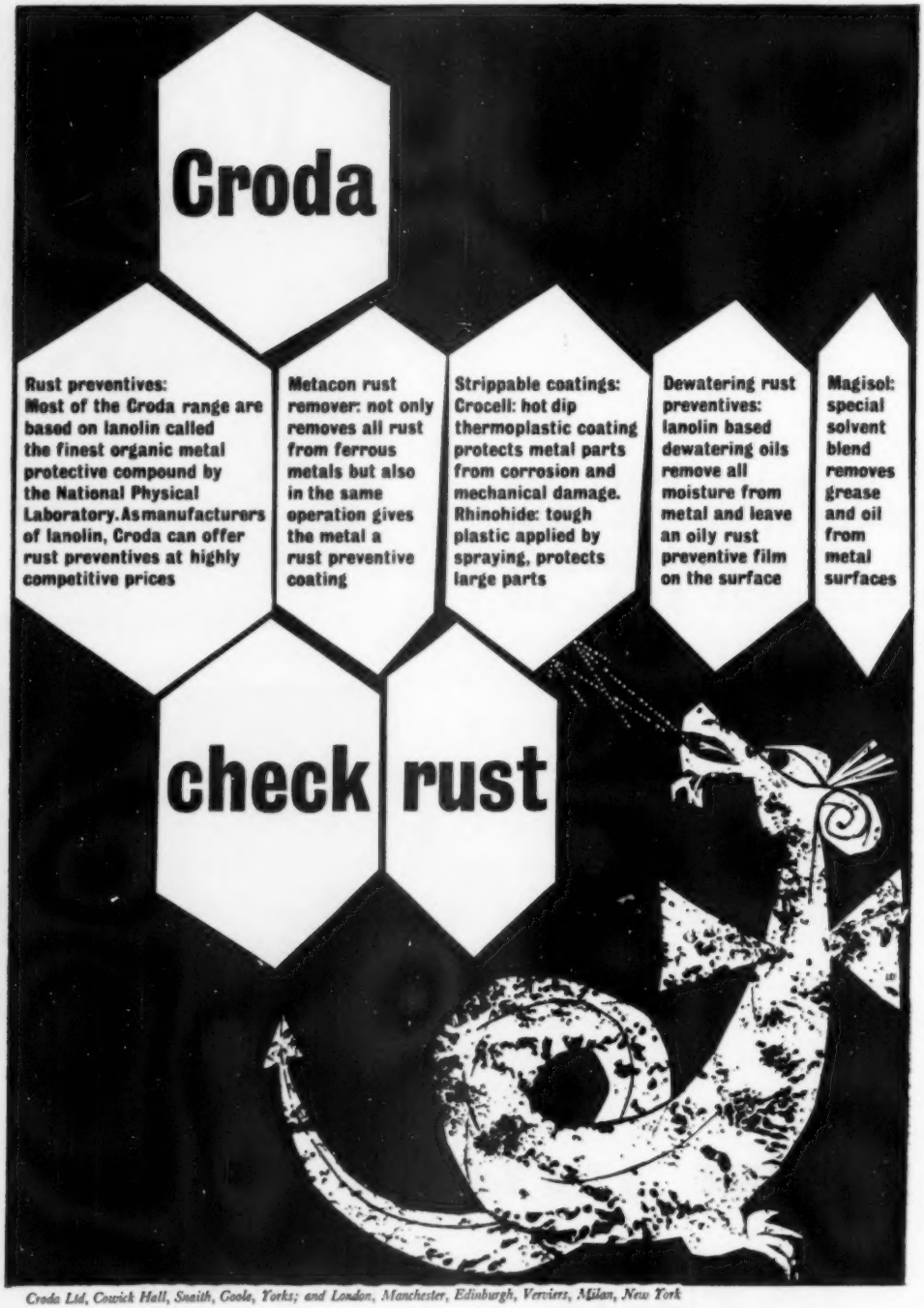
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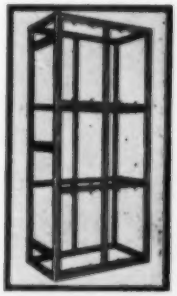
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The illustration shows a number of BRAUER 'Quick Action' TOGGLE CLAMPS types T.C.25 and T.C.80 being used to advantage on a brazing jig for the production of instrument panel frameworks by F. T. Davis (Kings Langley) Ltd.
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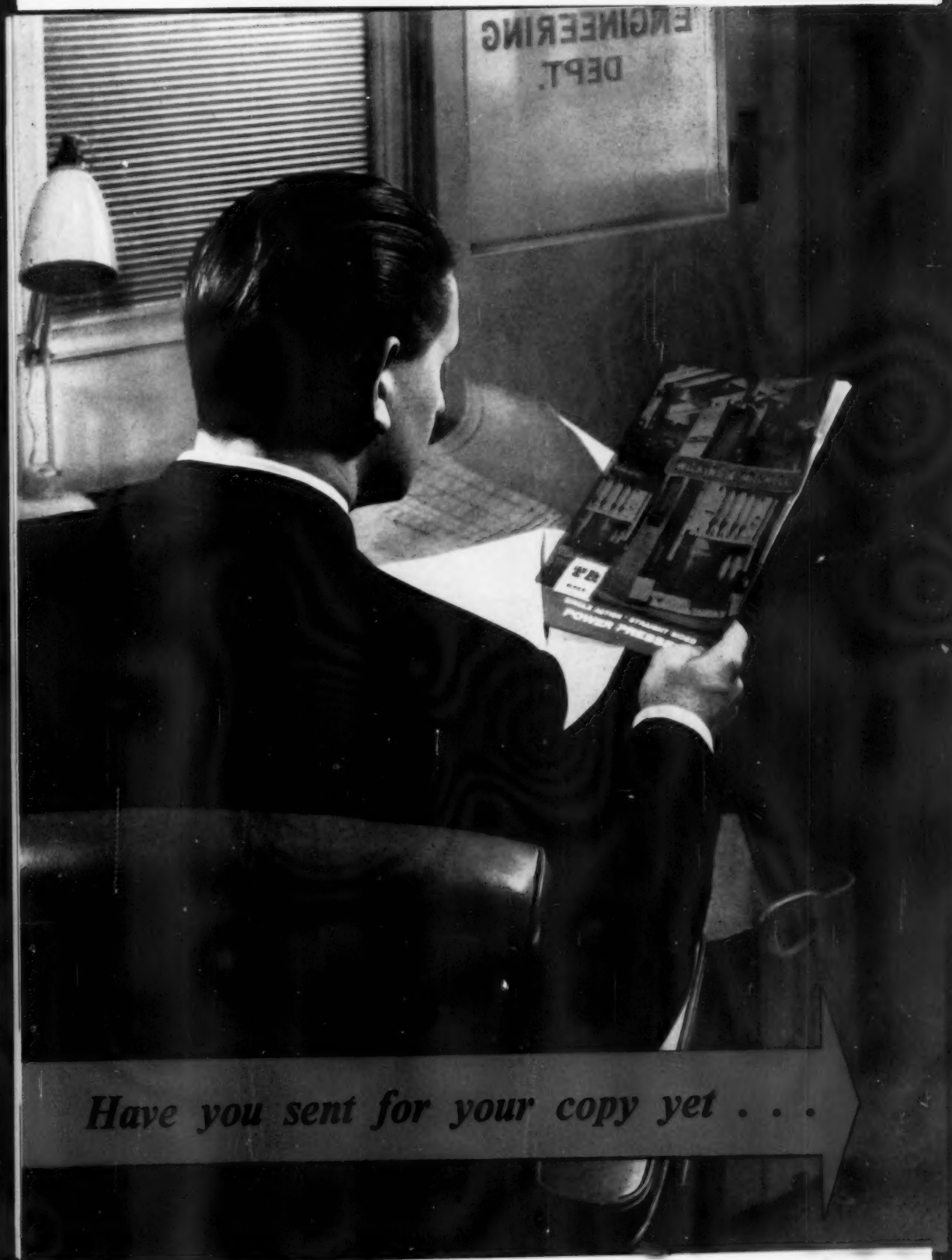
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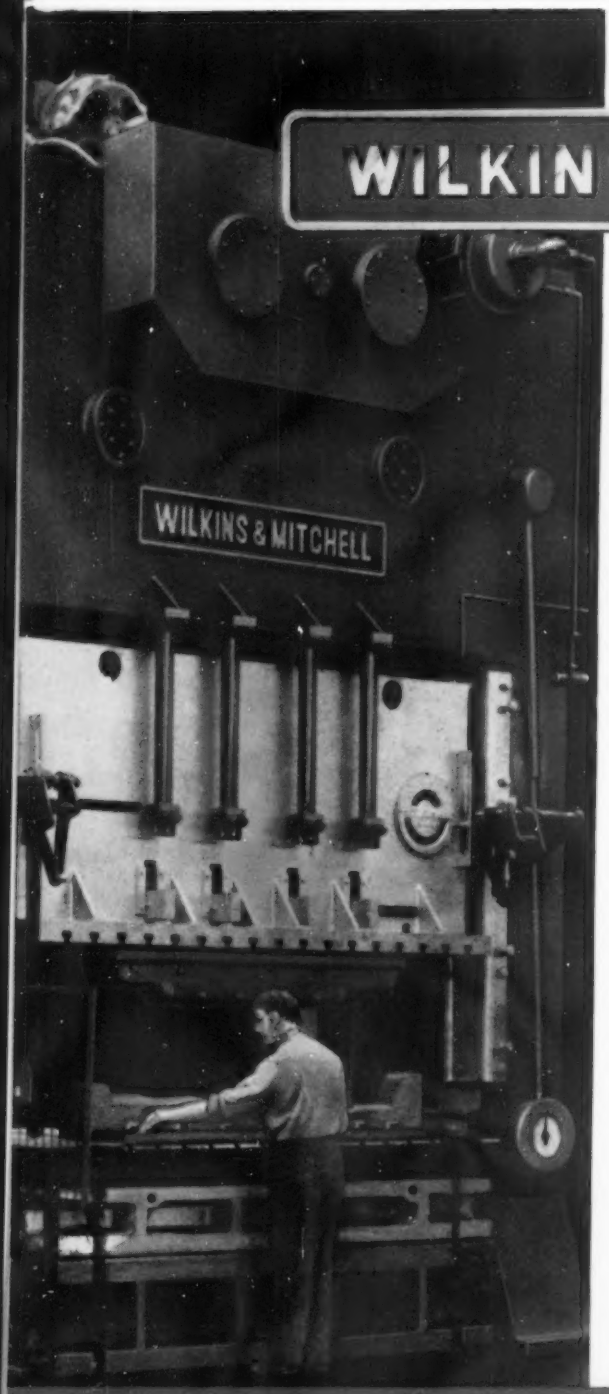
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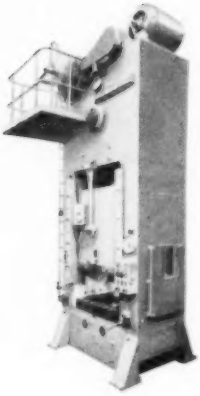
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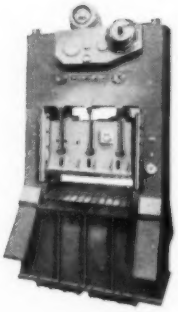
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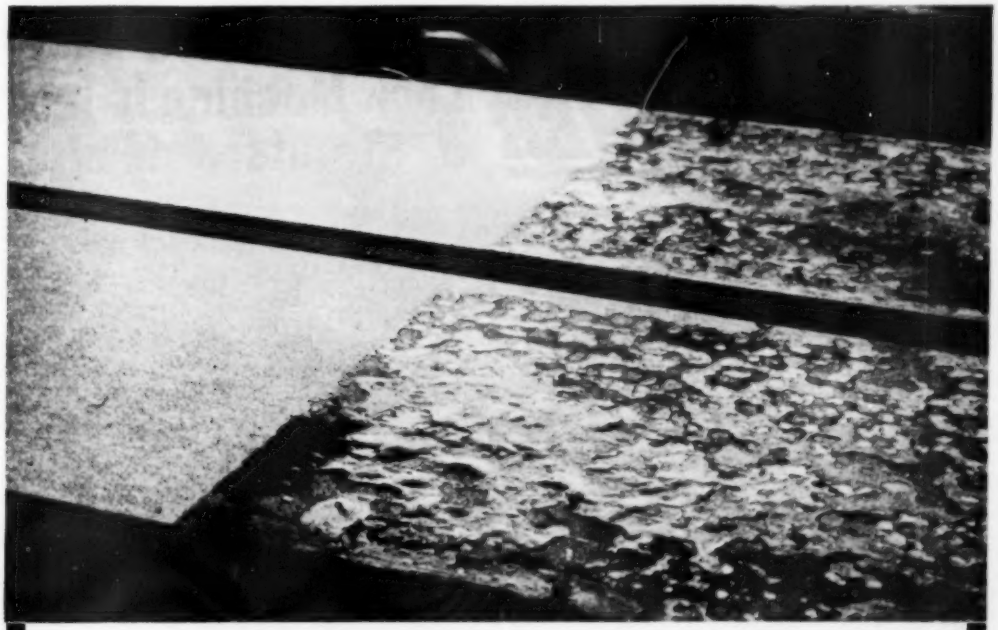




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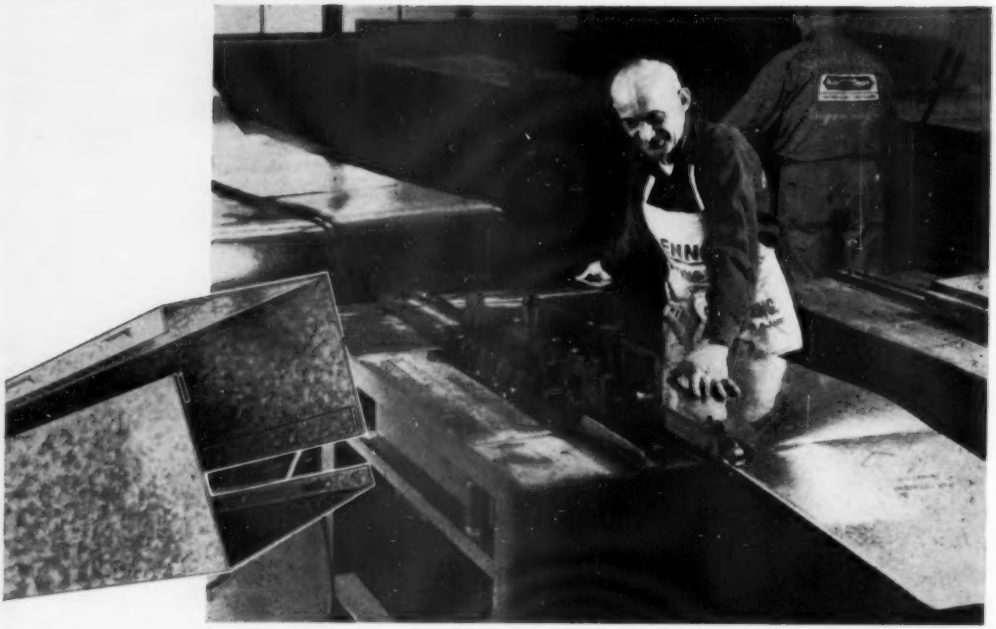
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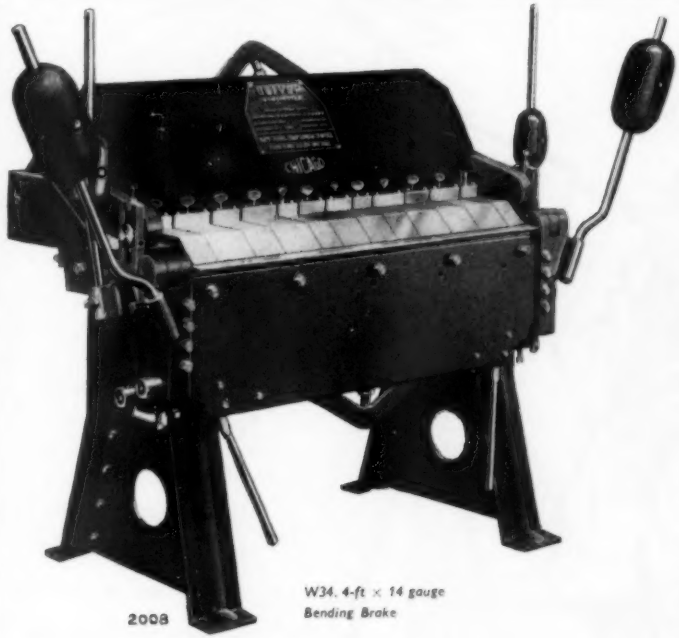
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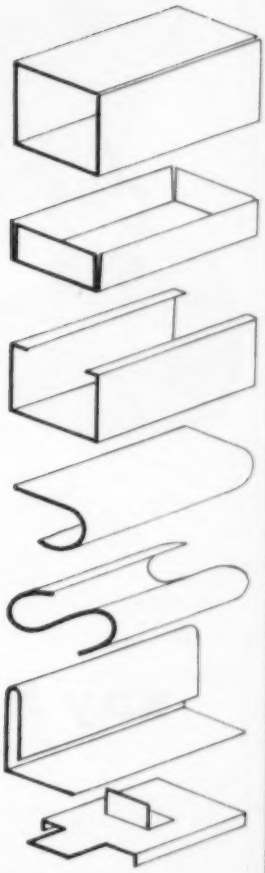
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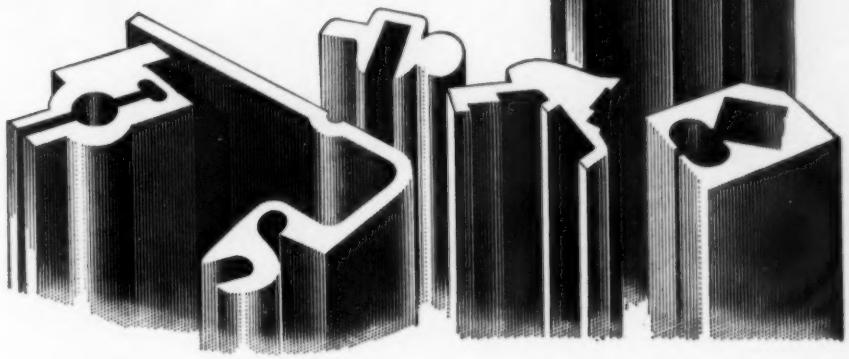
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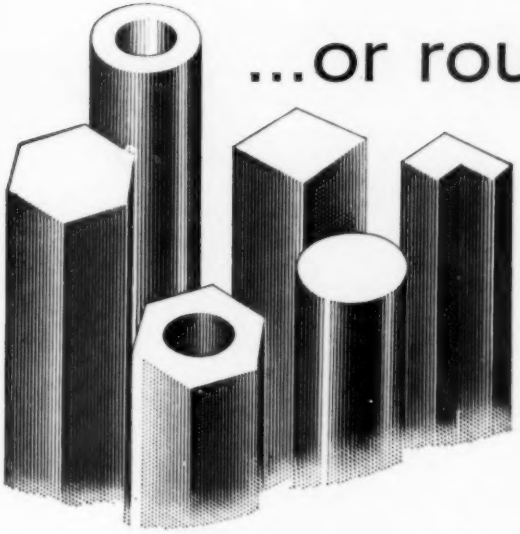
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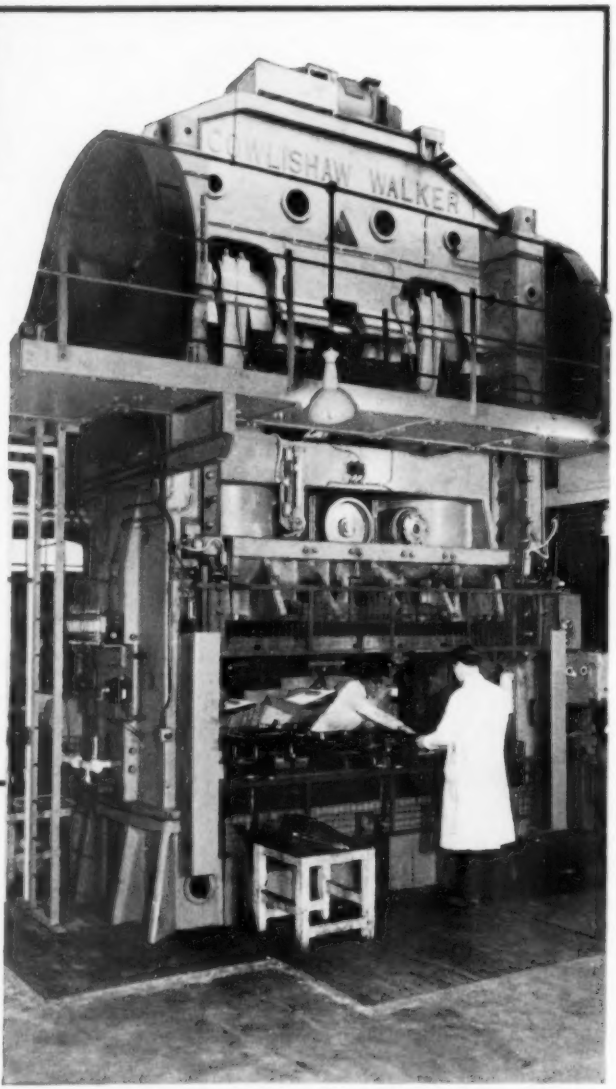


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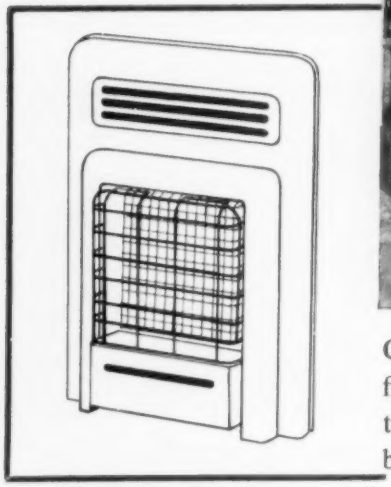
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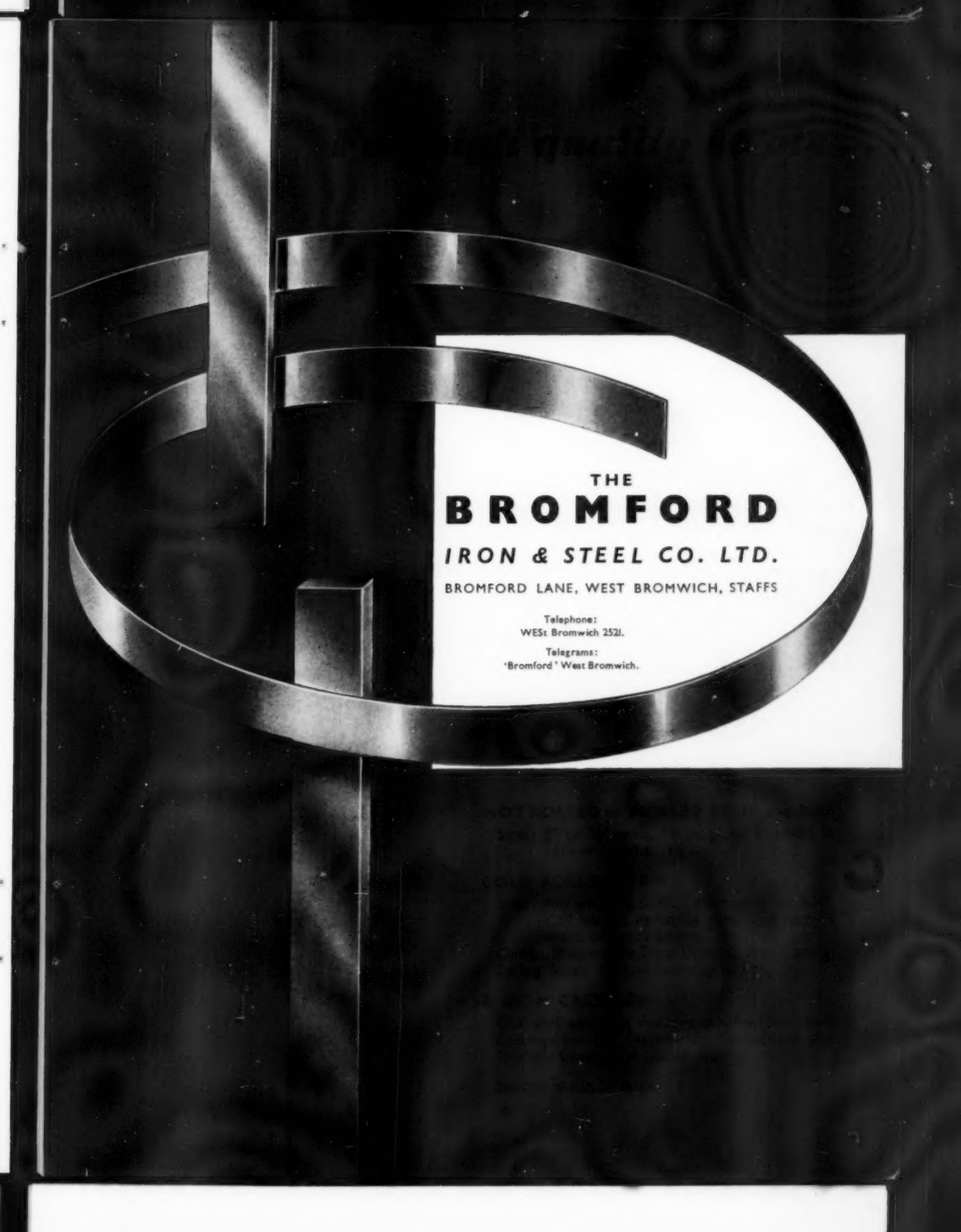
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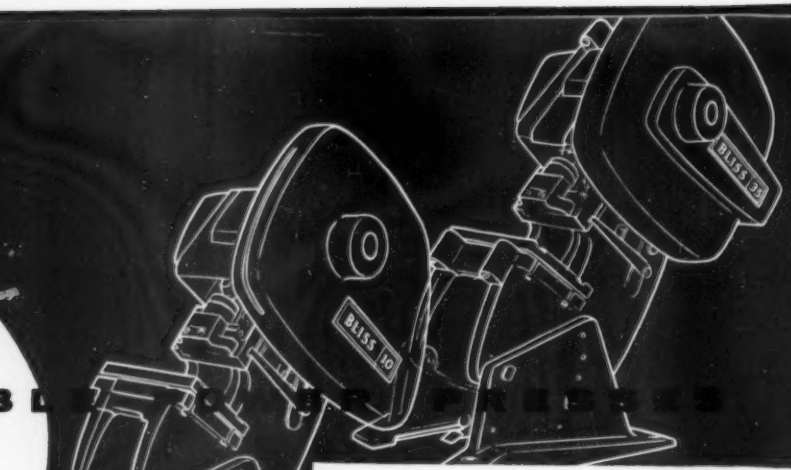
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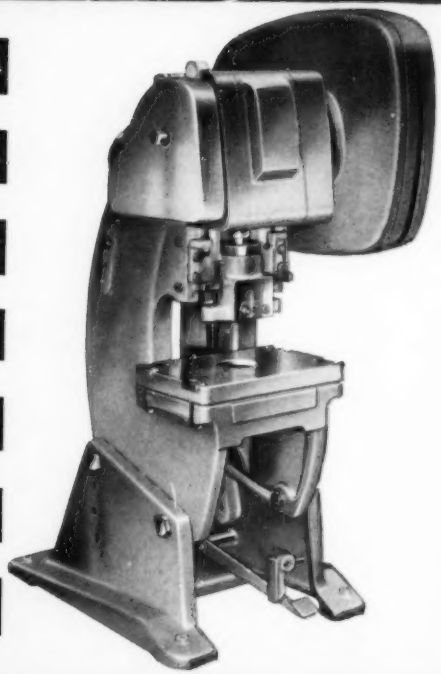
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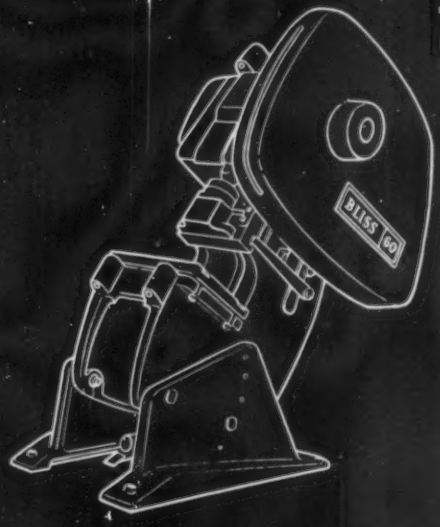
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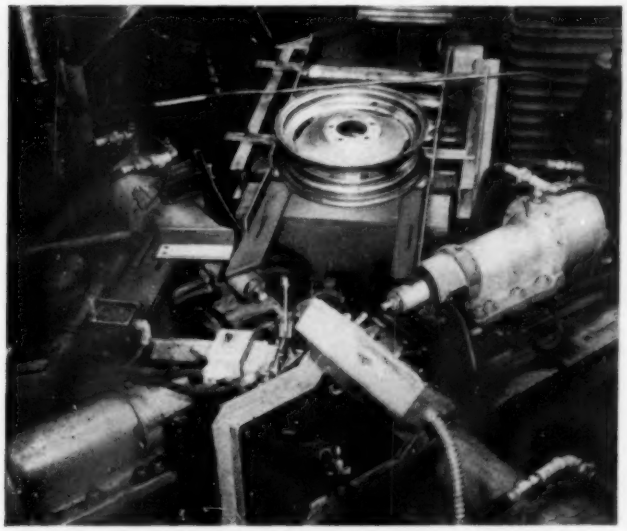
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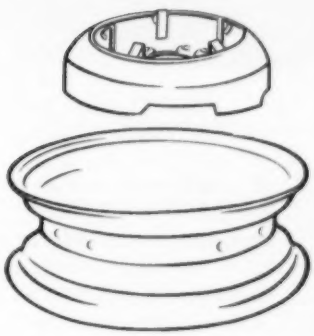
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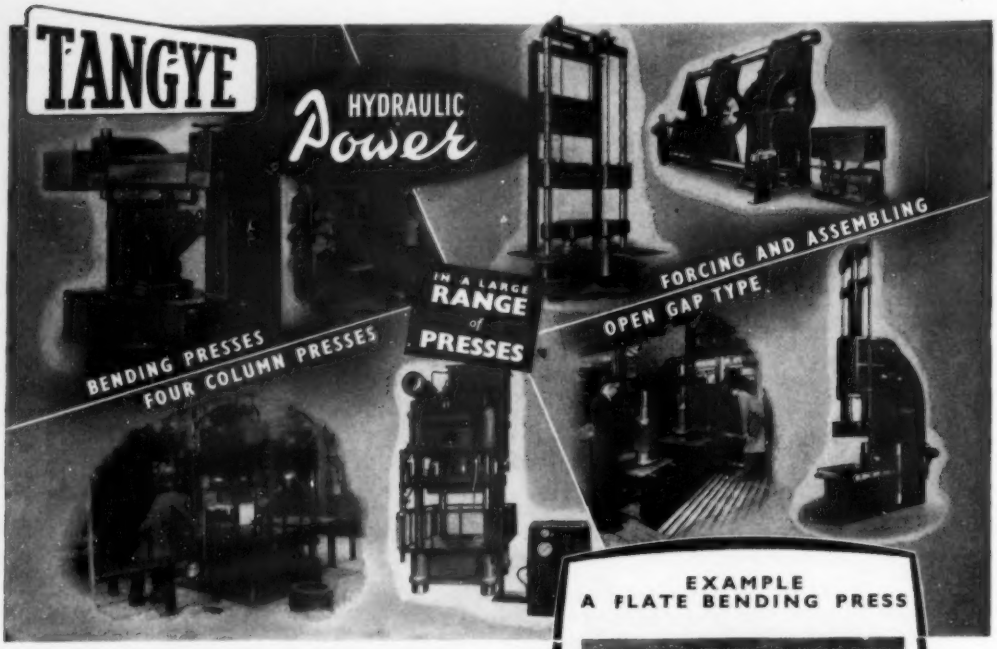
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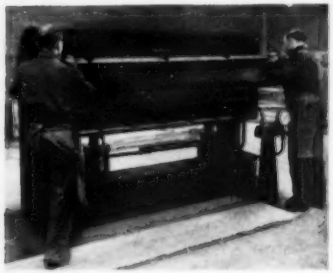


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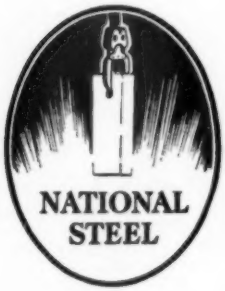
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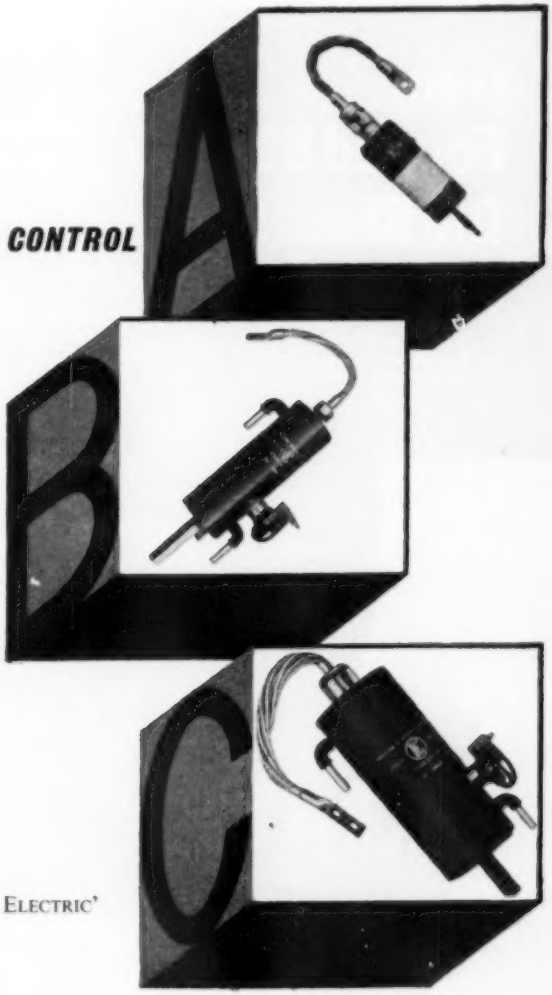
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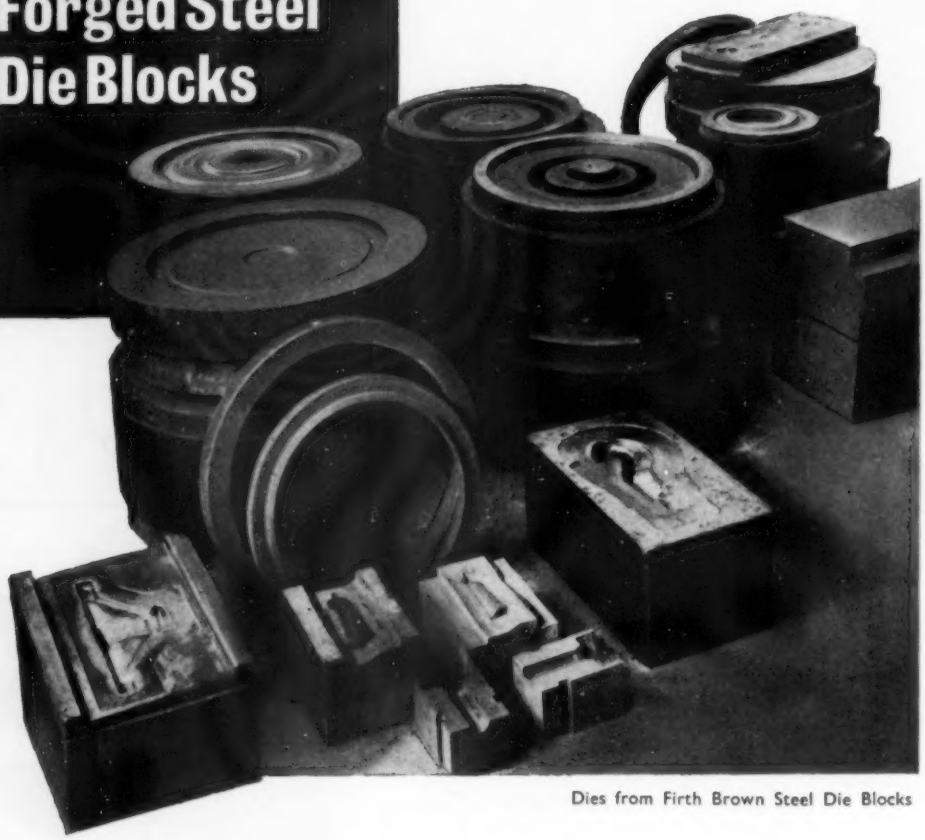
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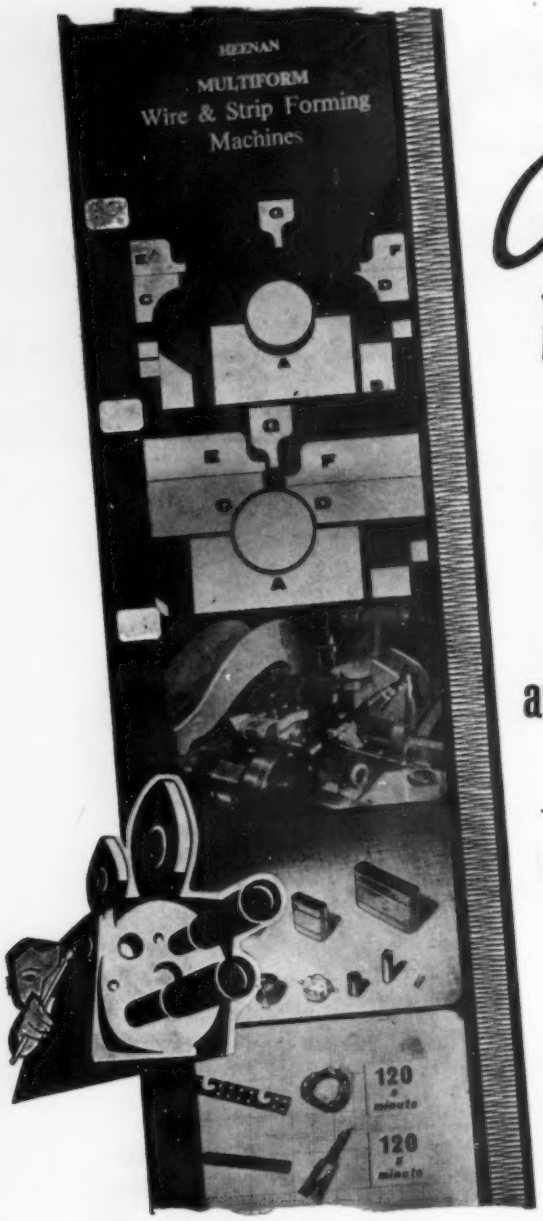
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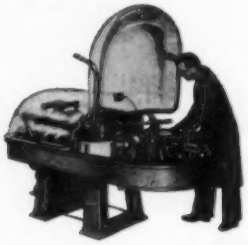
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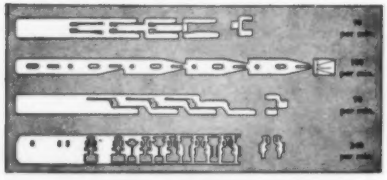
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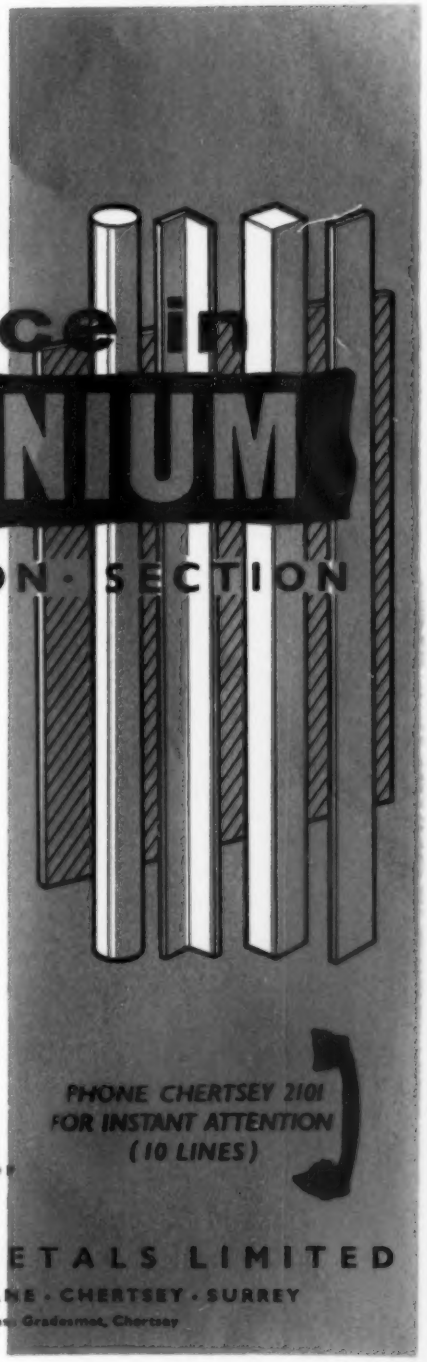


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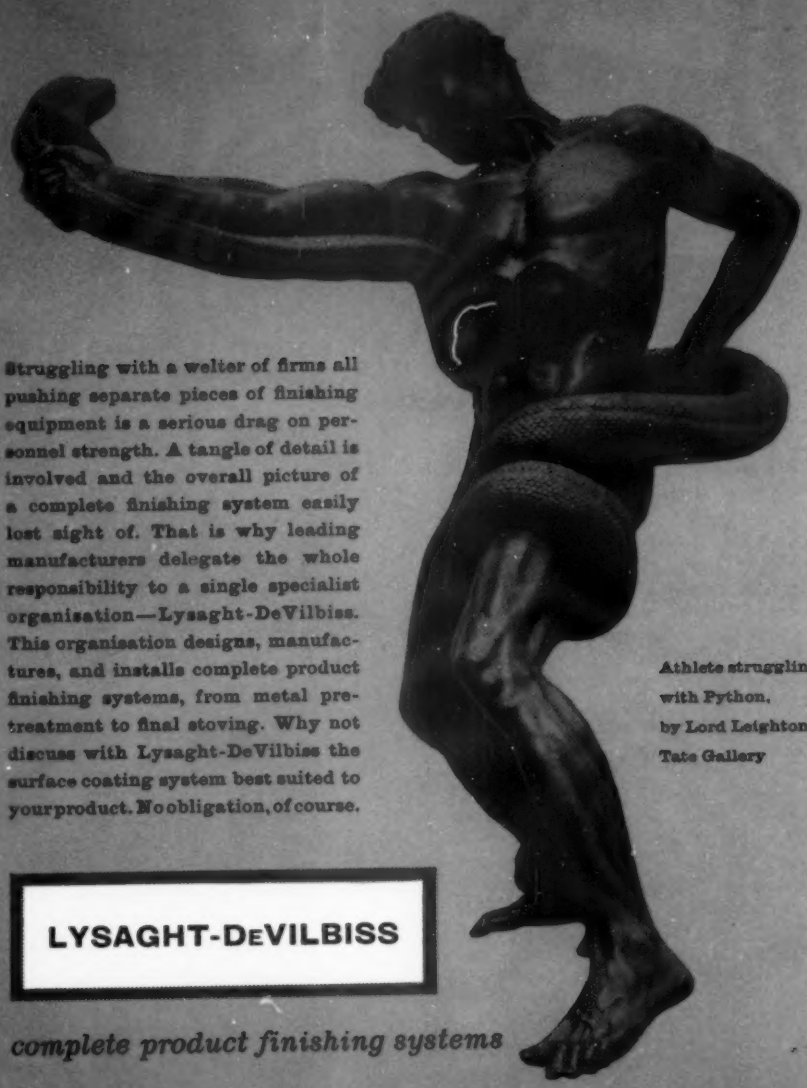


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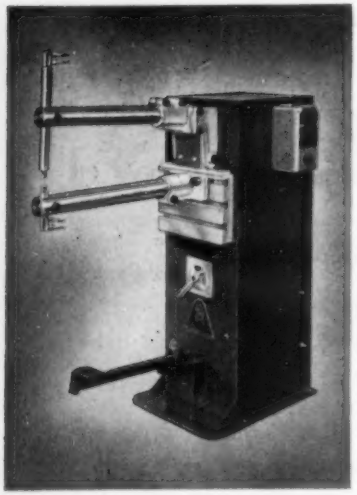
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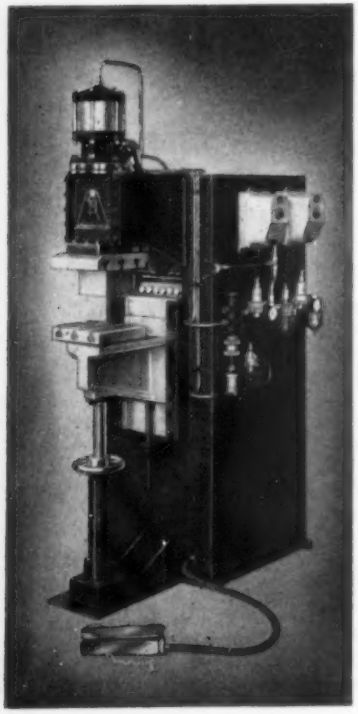
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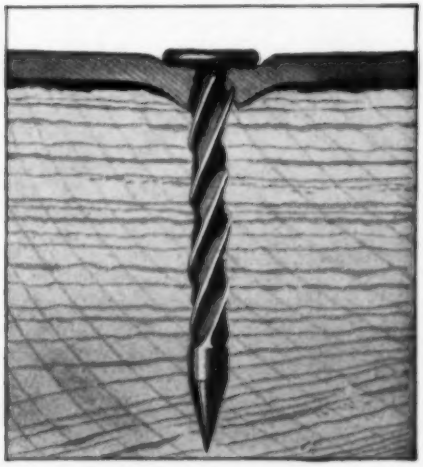
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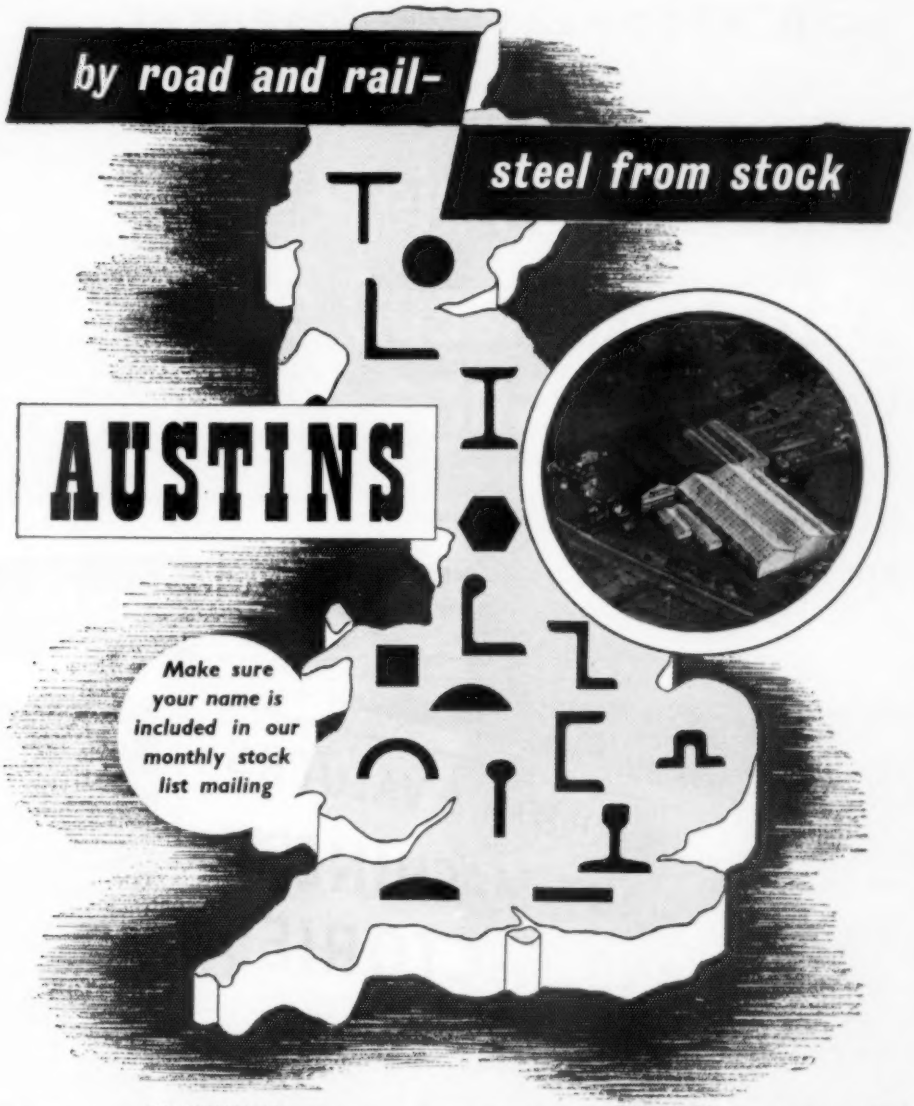
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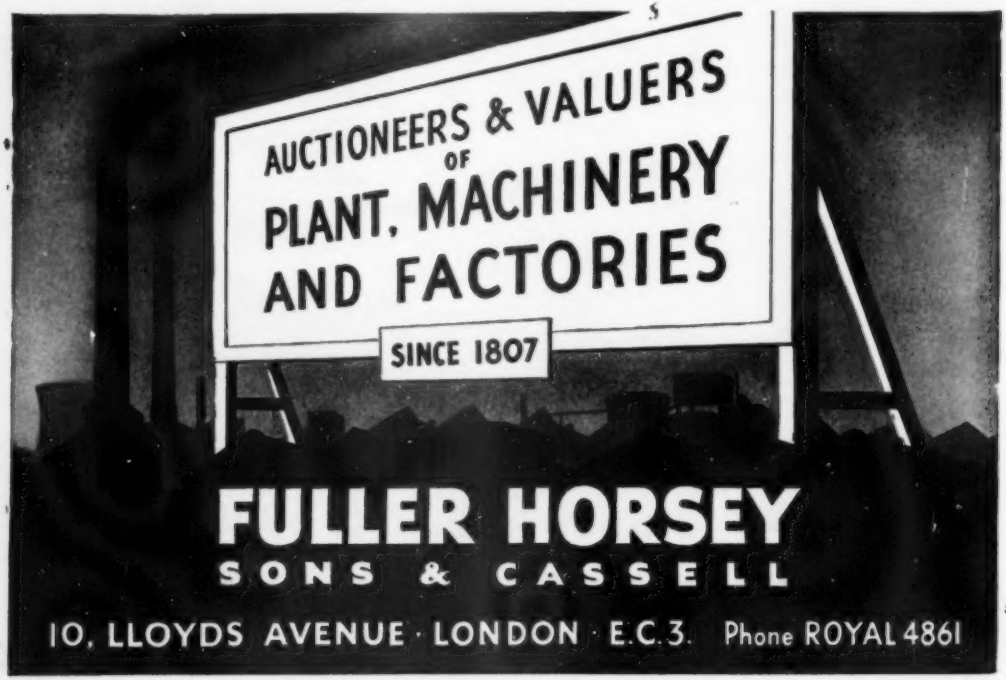
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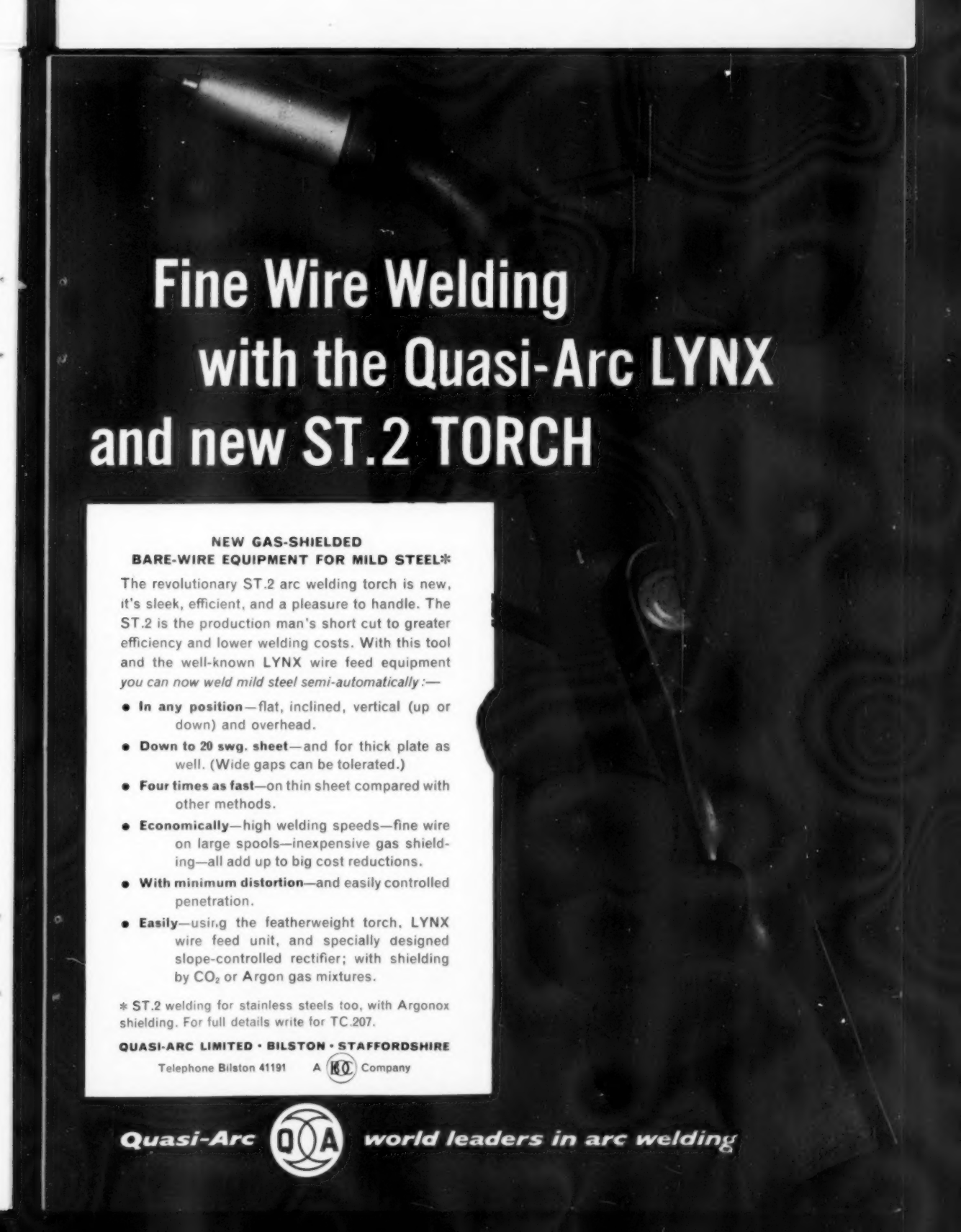
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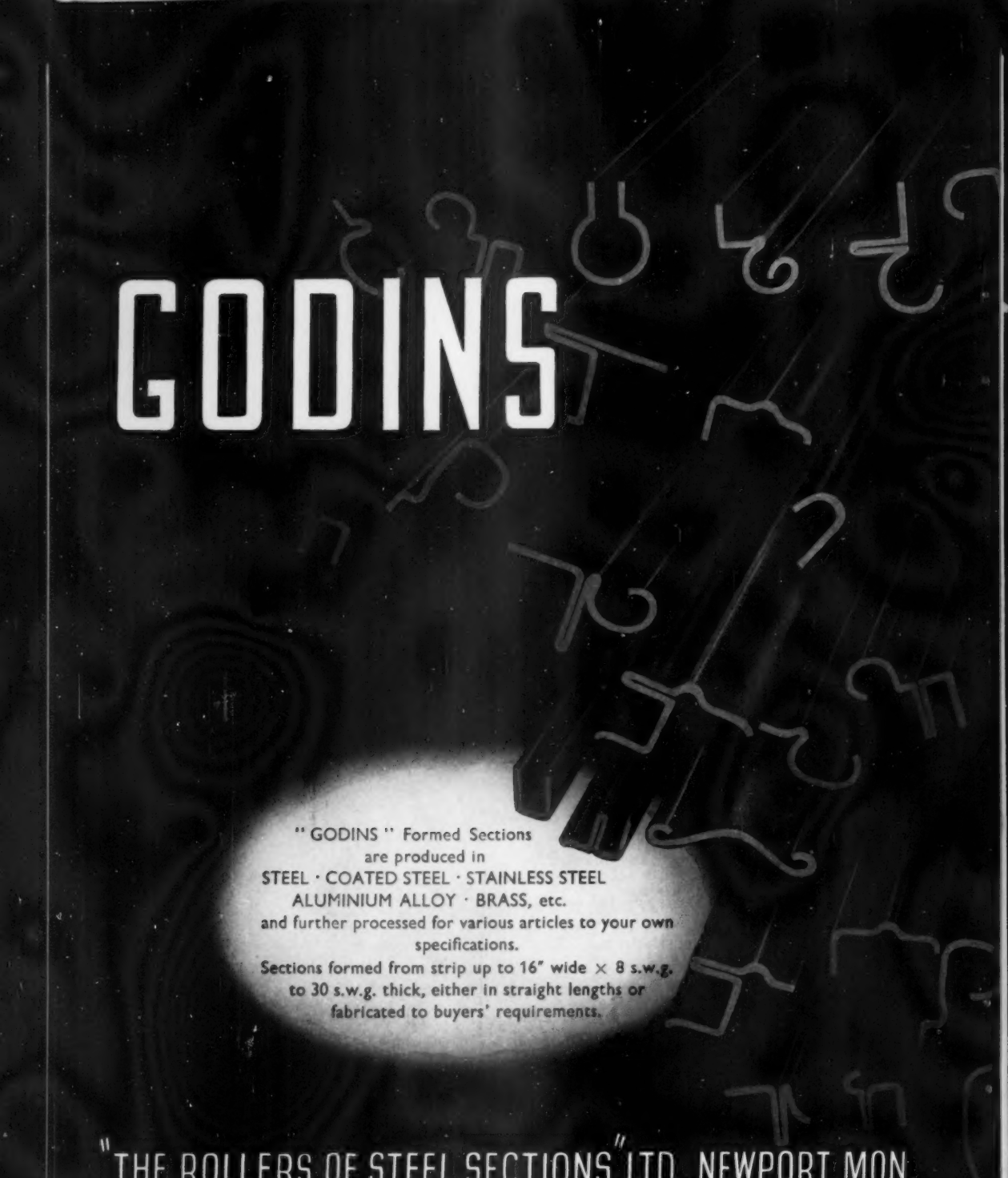
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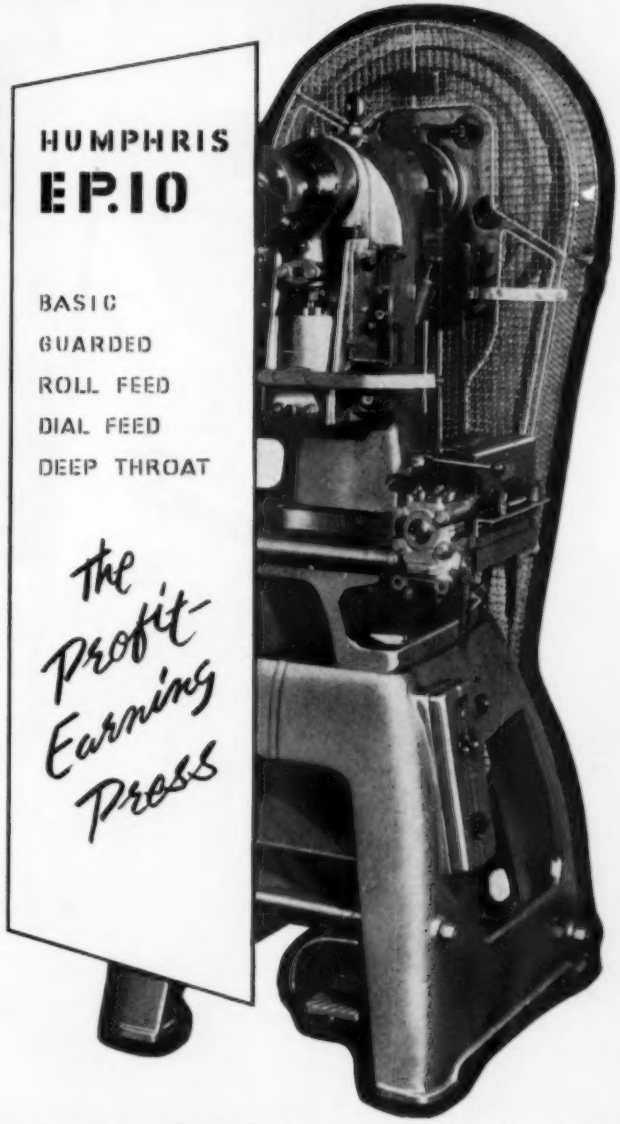
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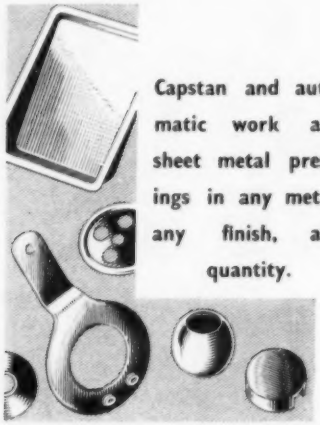


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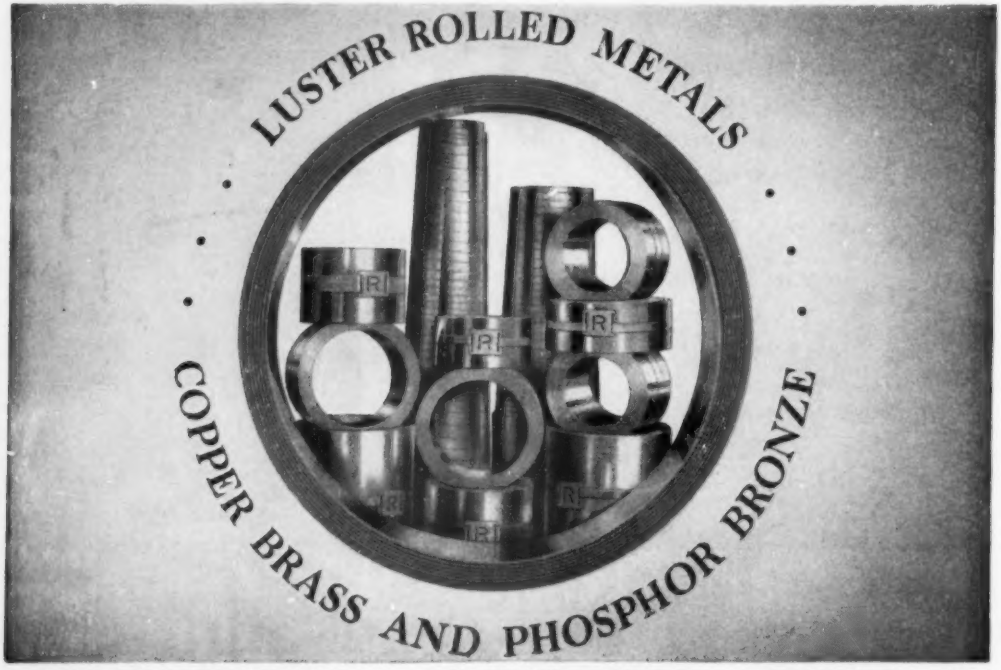
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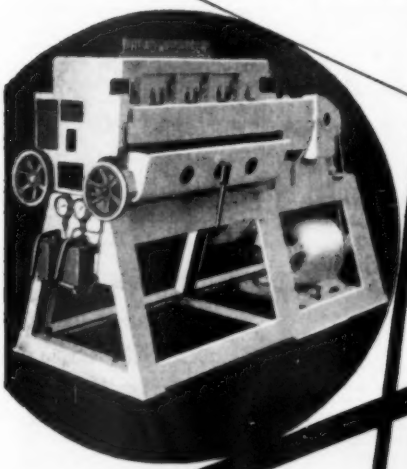
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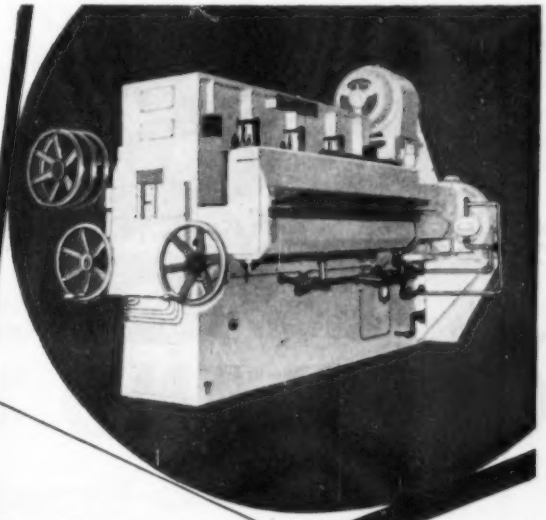


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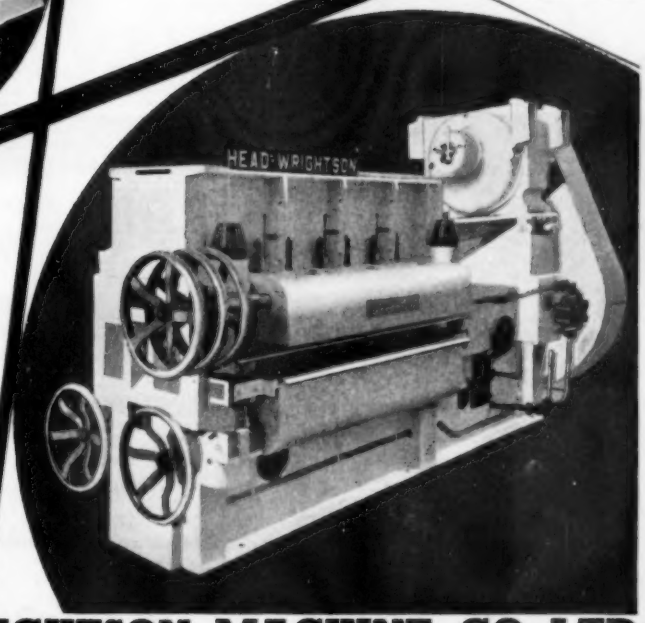
Left: 1½" Pressure Regulating Roller Leveller





Top: 1¼" Processor Leveller

Bottom: 2½" Pressure Regulating Roller Leveller



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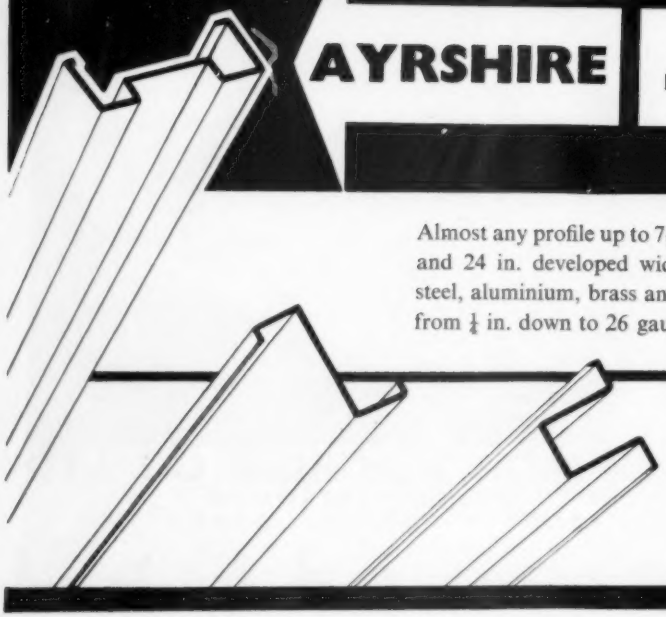
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Then, all tryumphant cride "Huzzay!"
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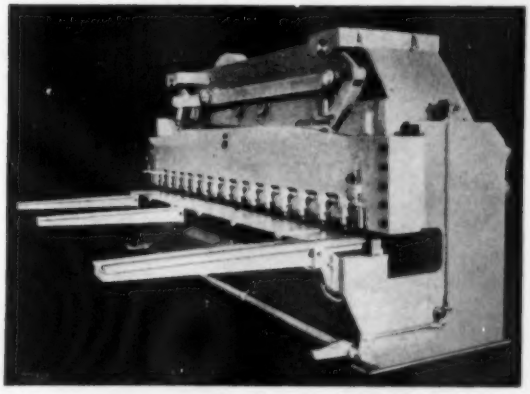
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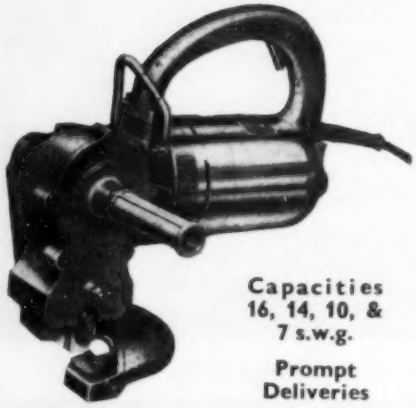
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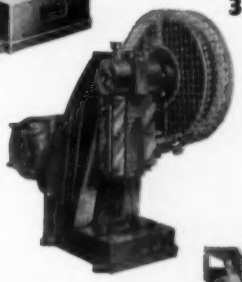
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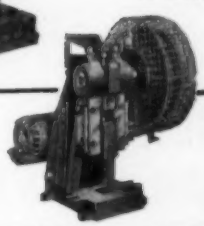
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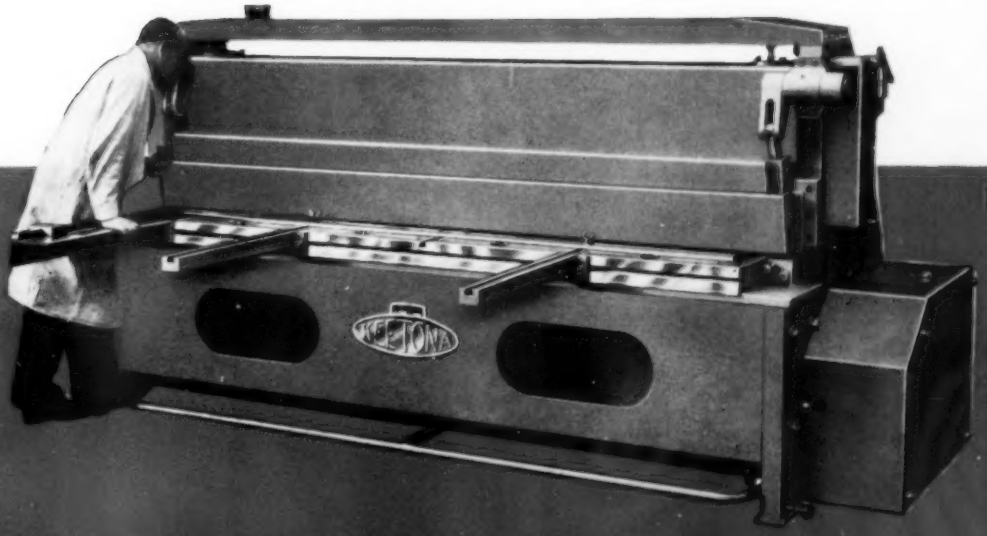
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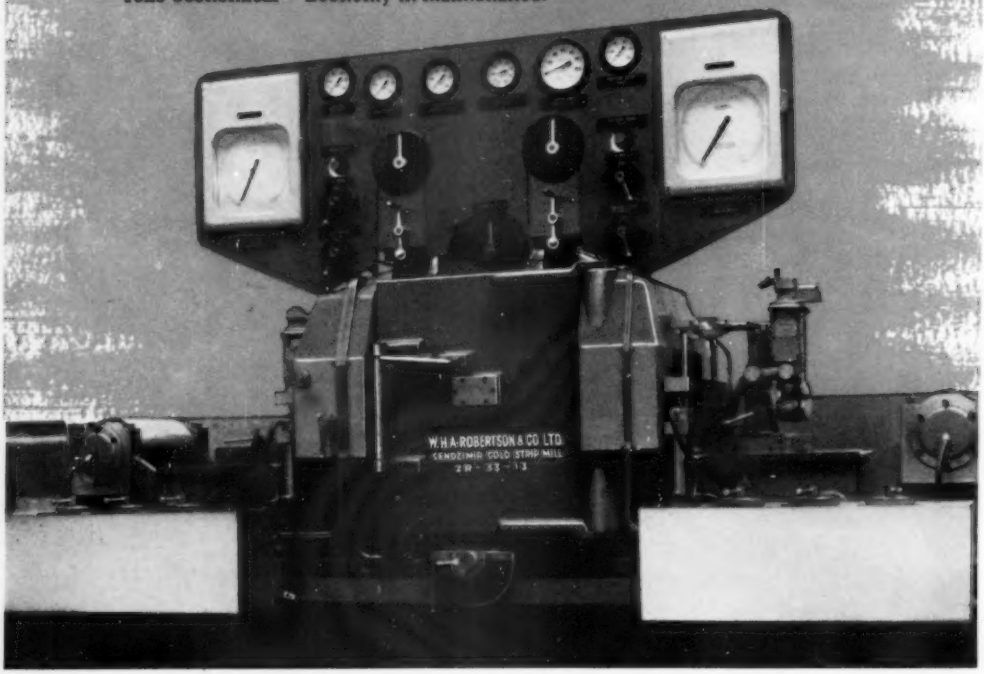
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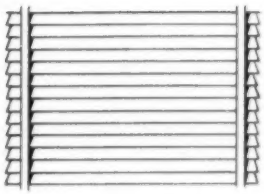


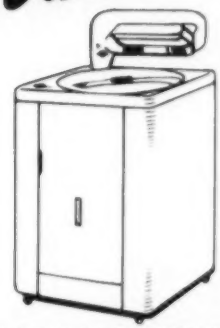
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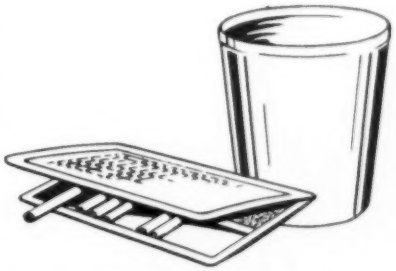
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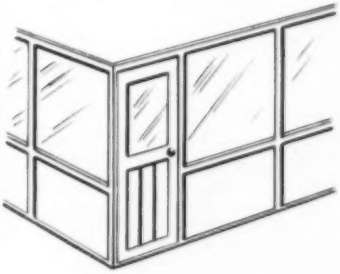
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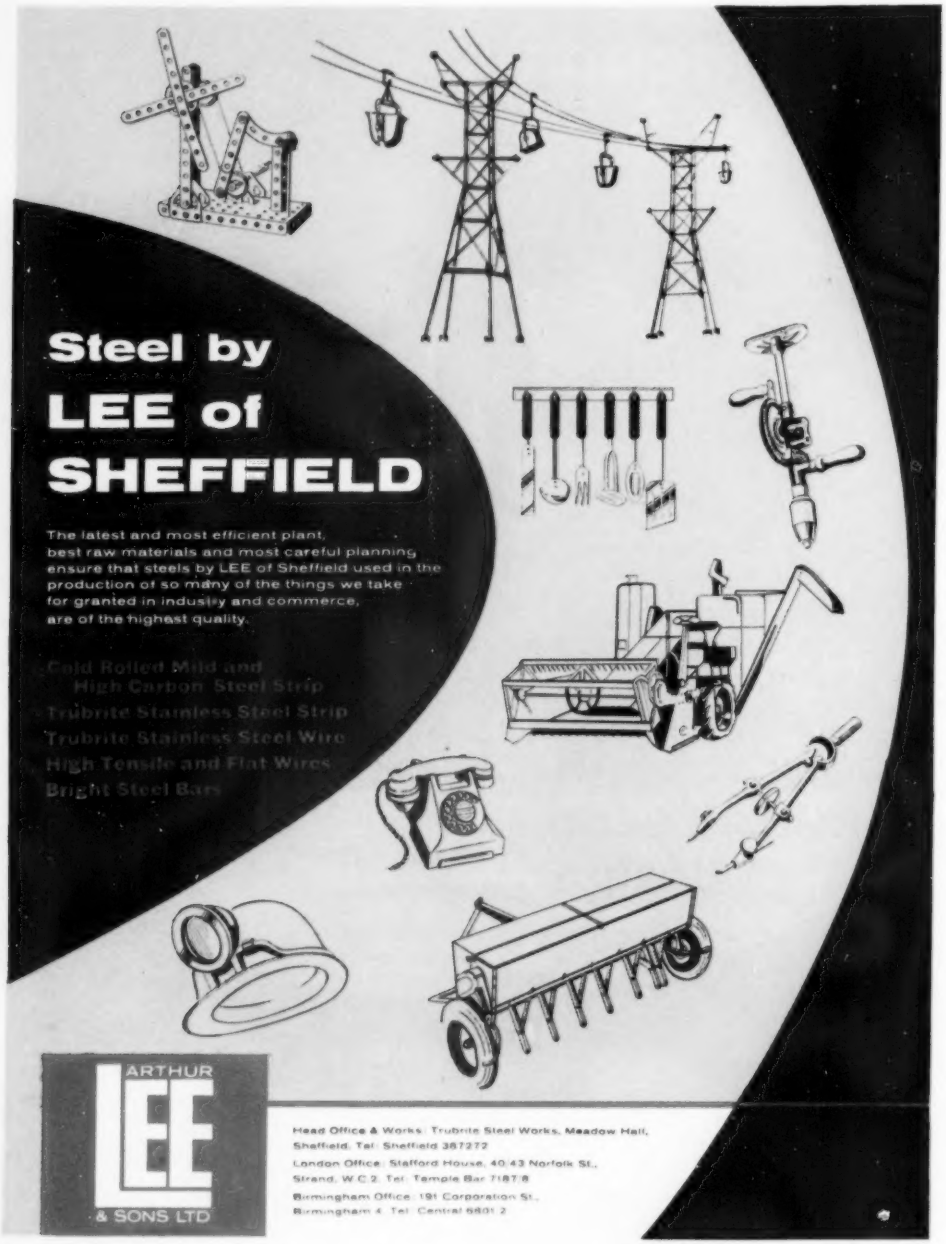
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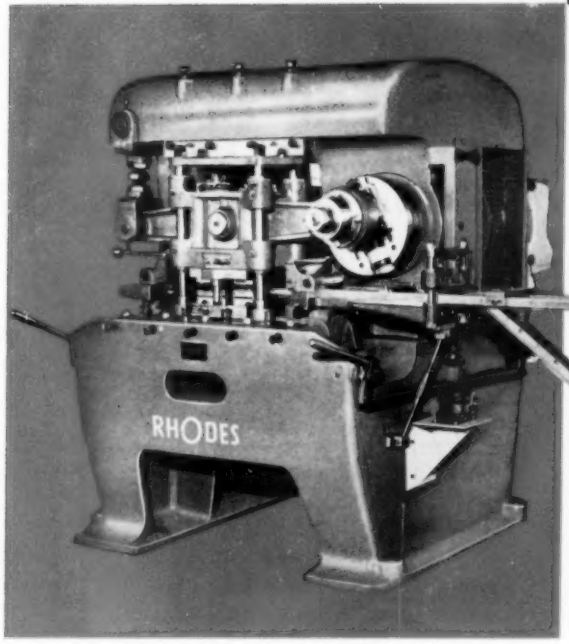
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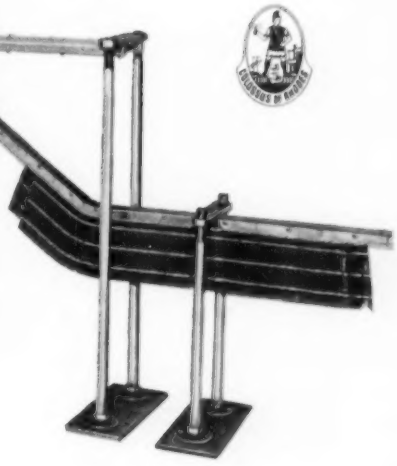

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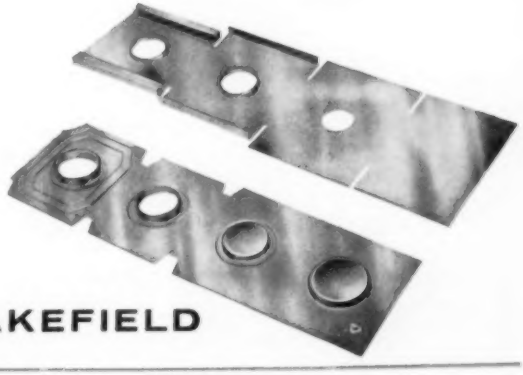


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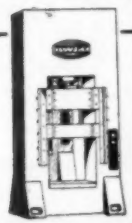
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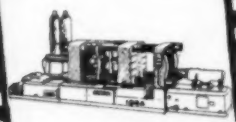
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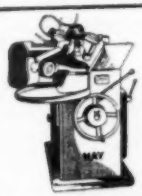
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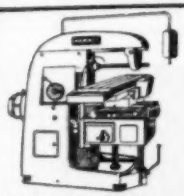
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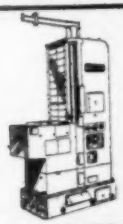
IDRA
DIE CASTING MACHINES



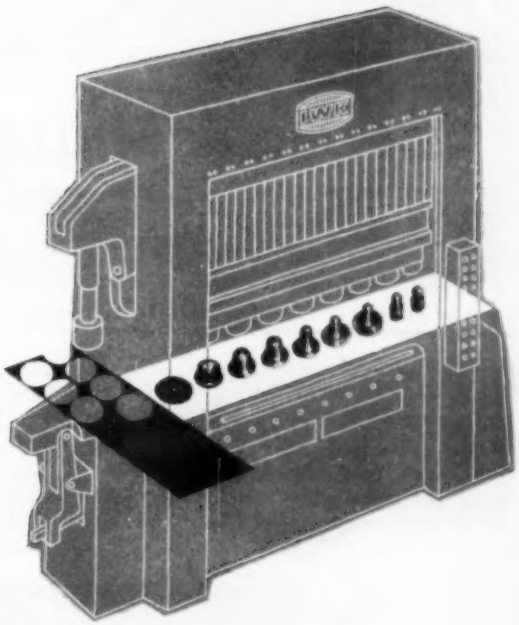
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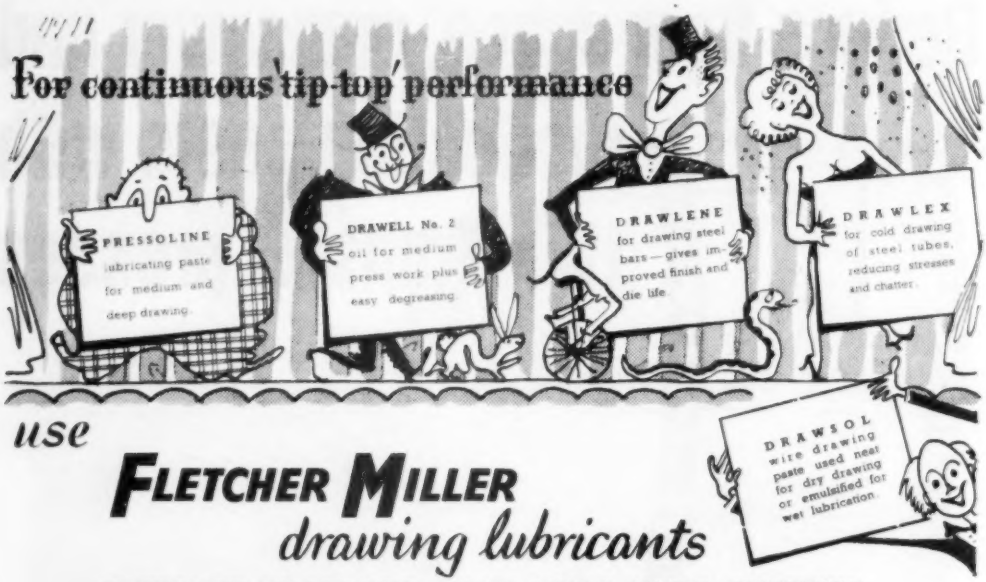


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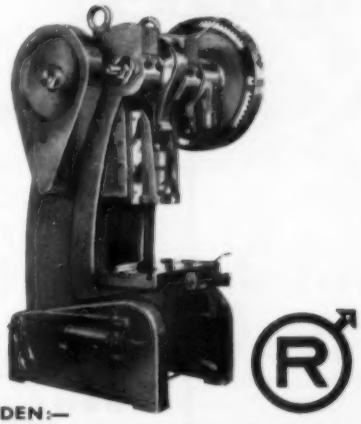


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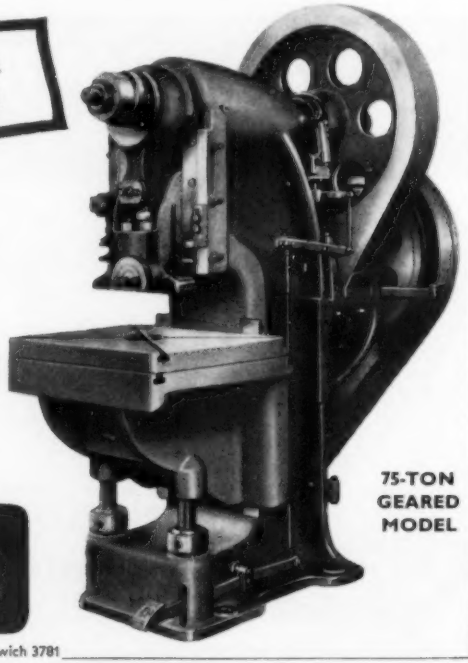
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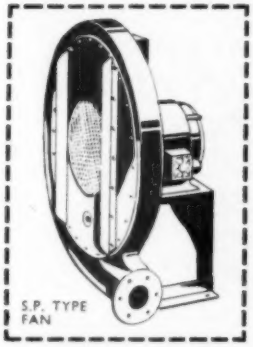
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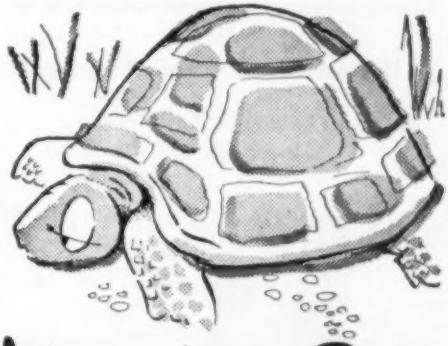
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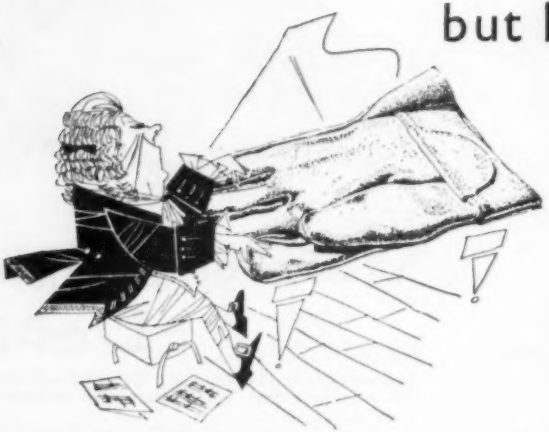
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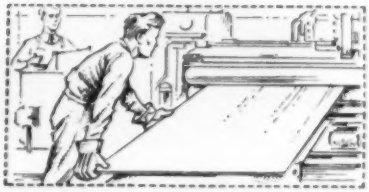
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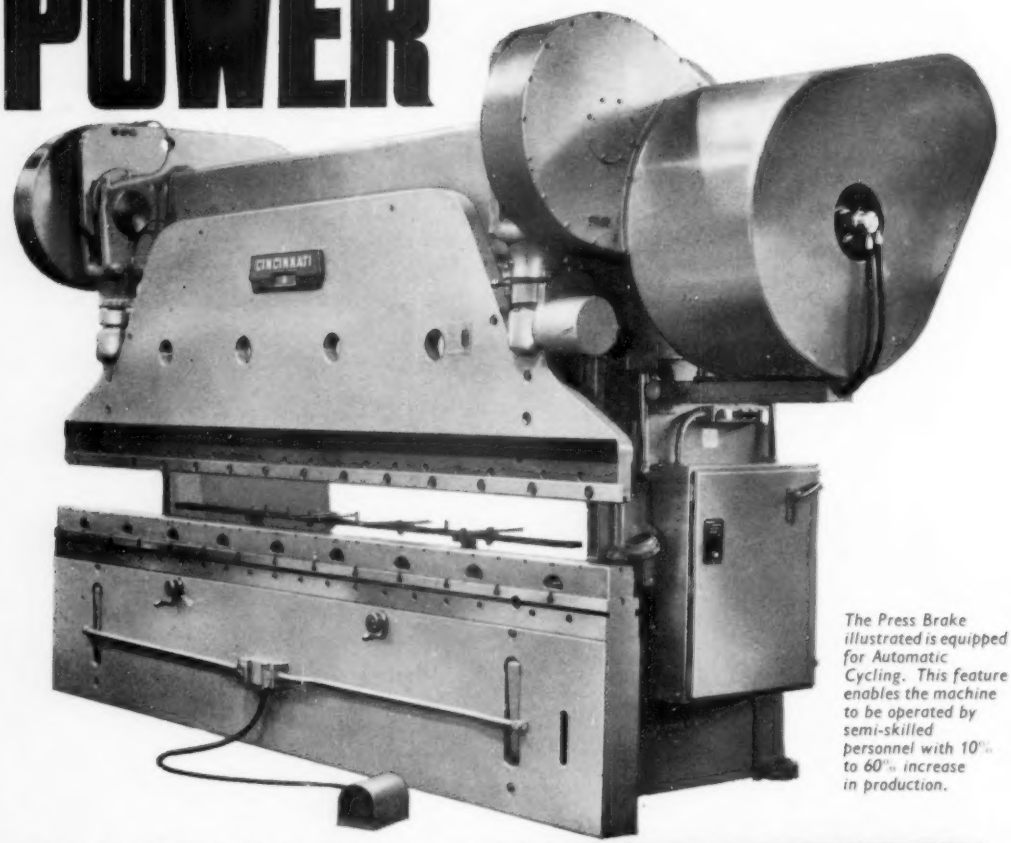
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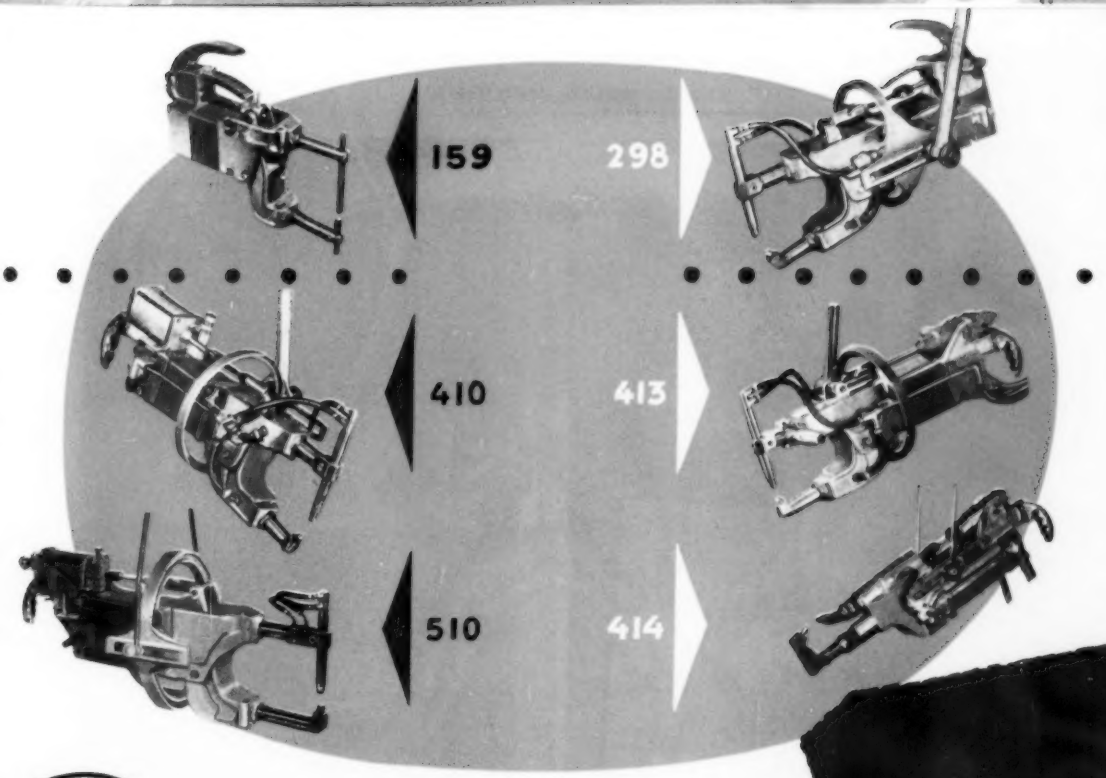
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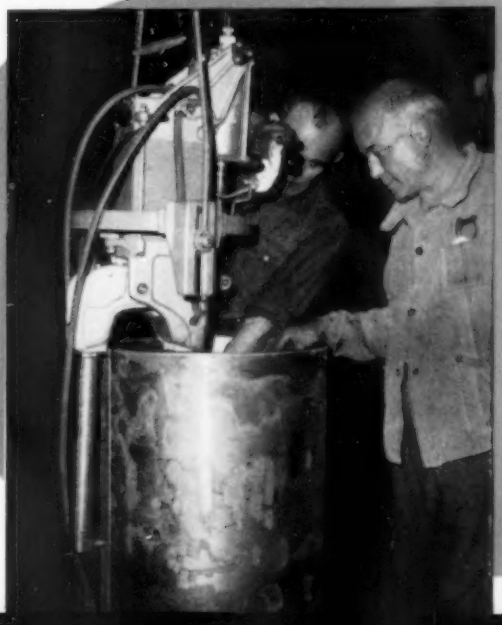
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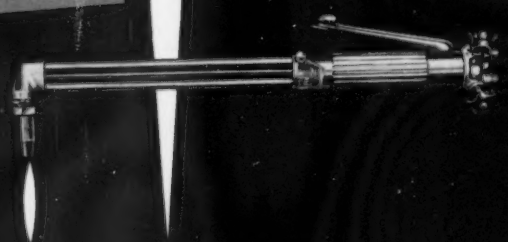
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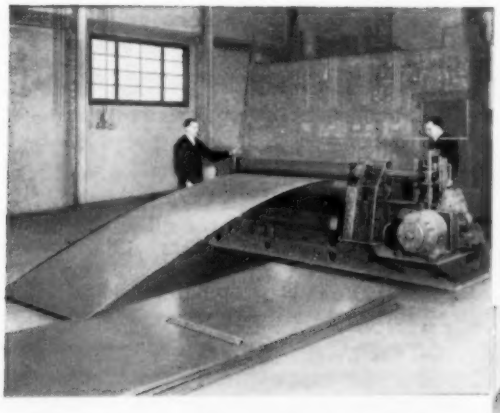
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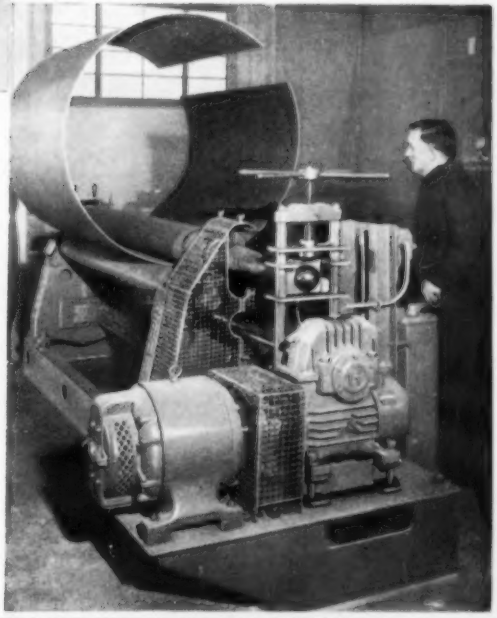
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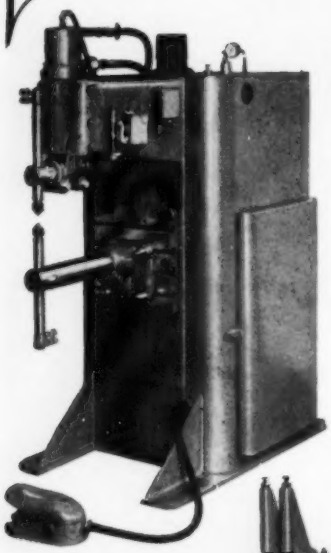
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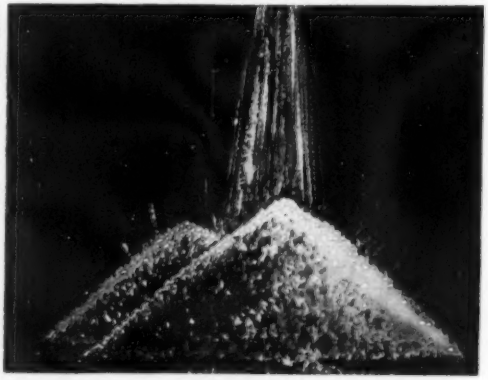
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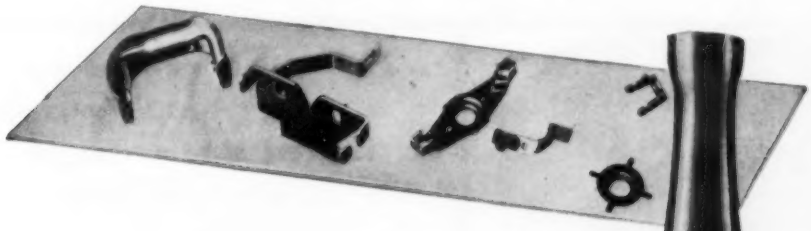


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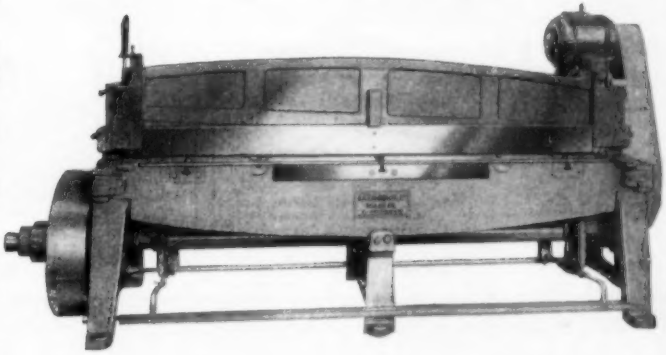
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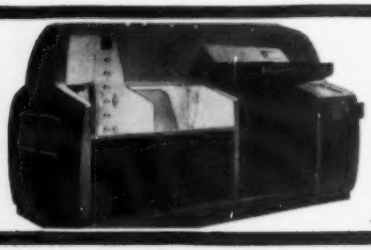
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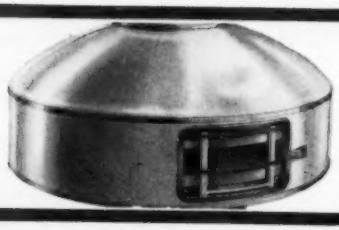
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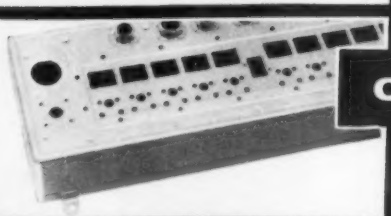
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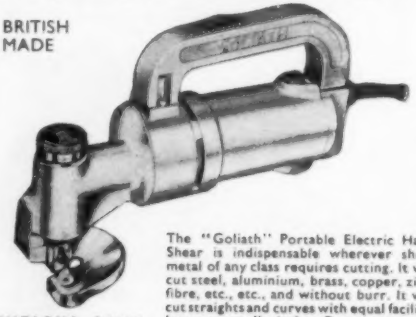
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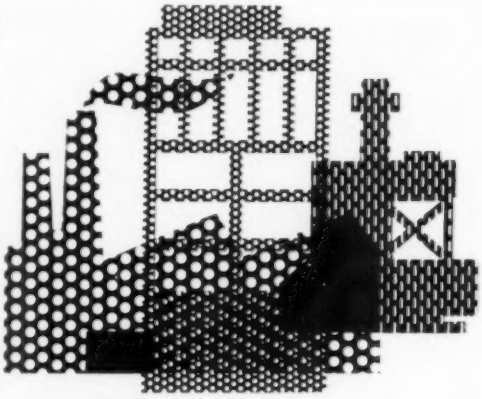
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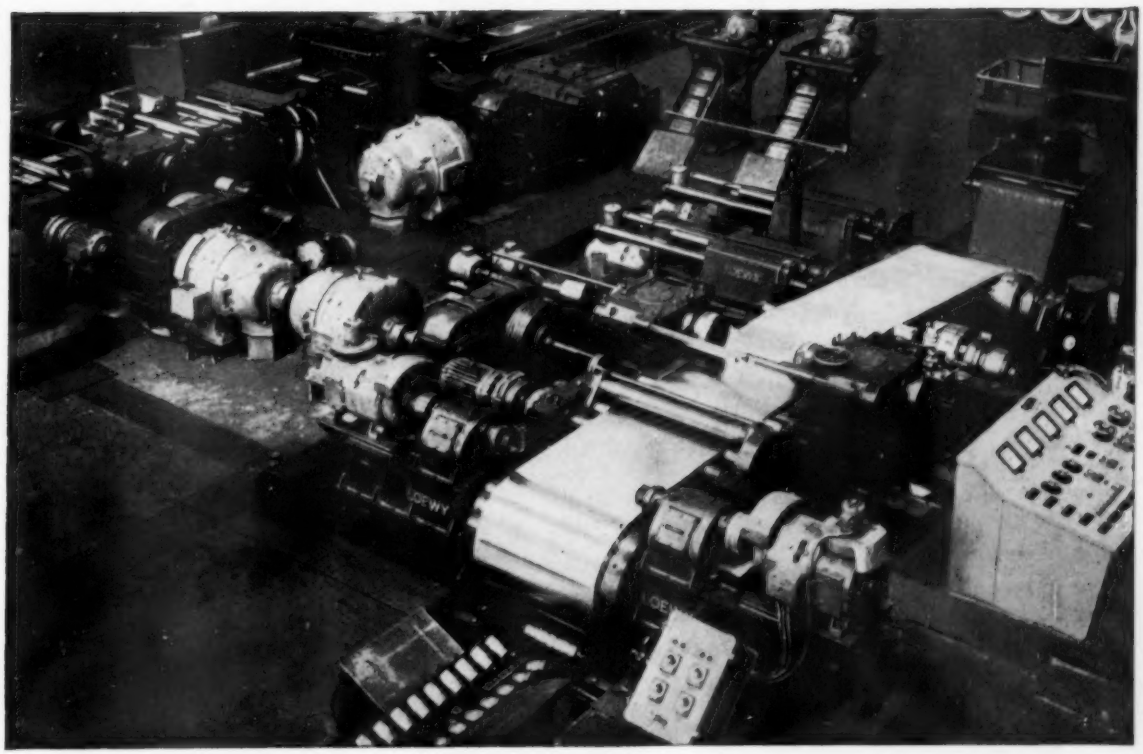
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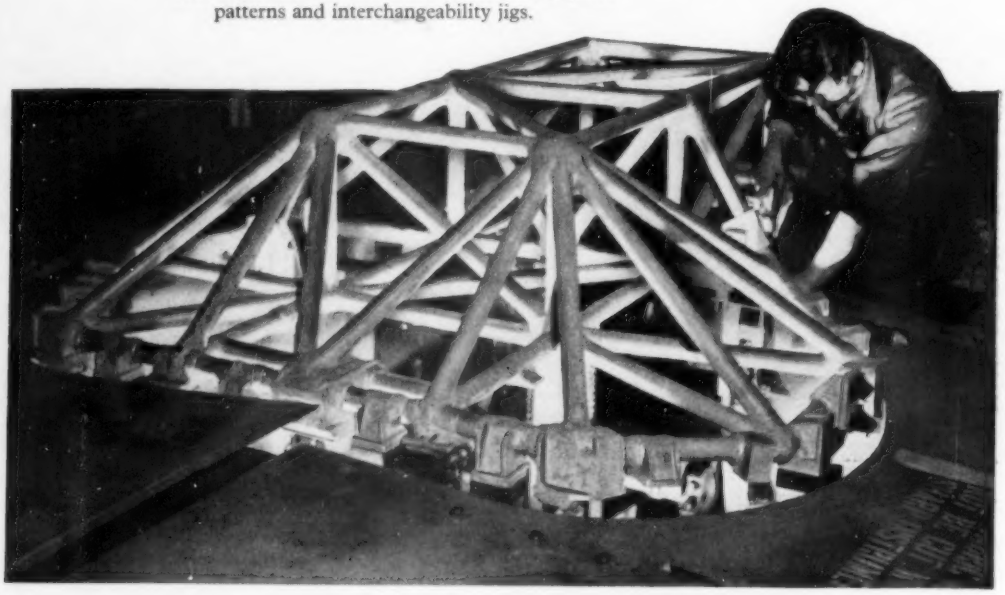
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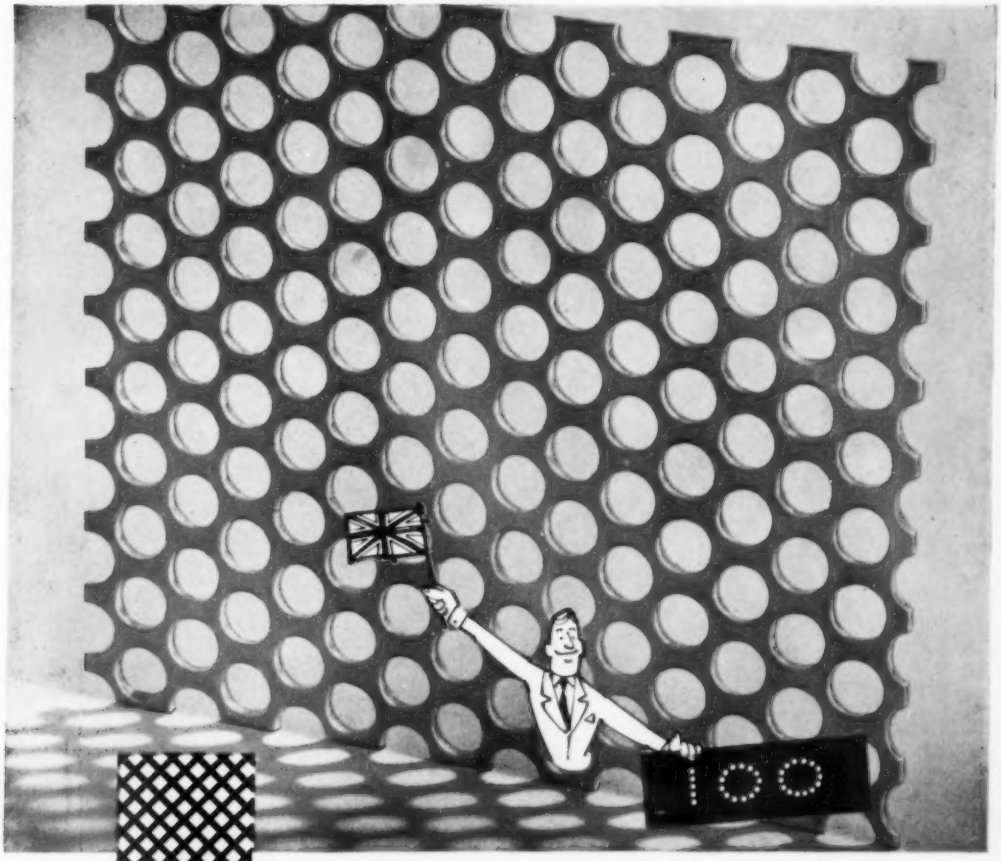
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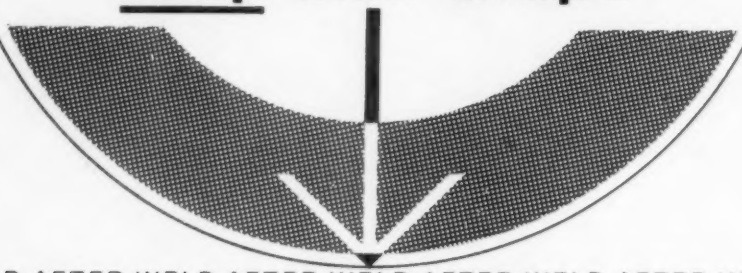


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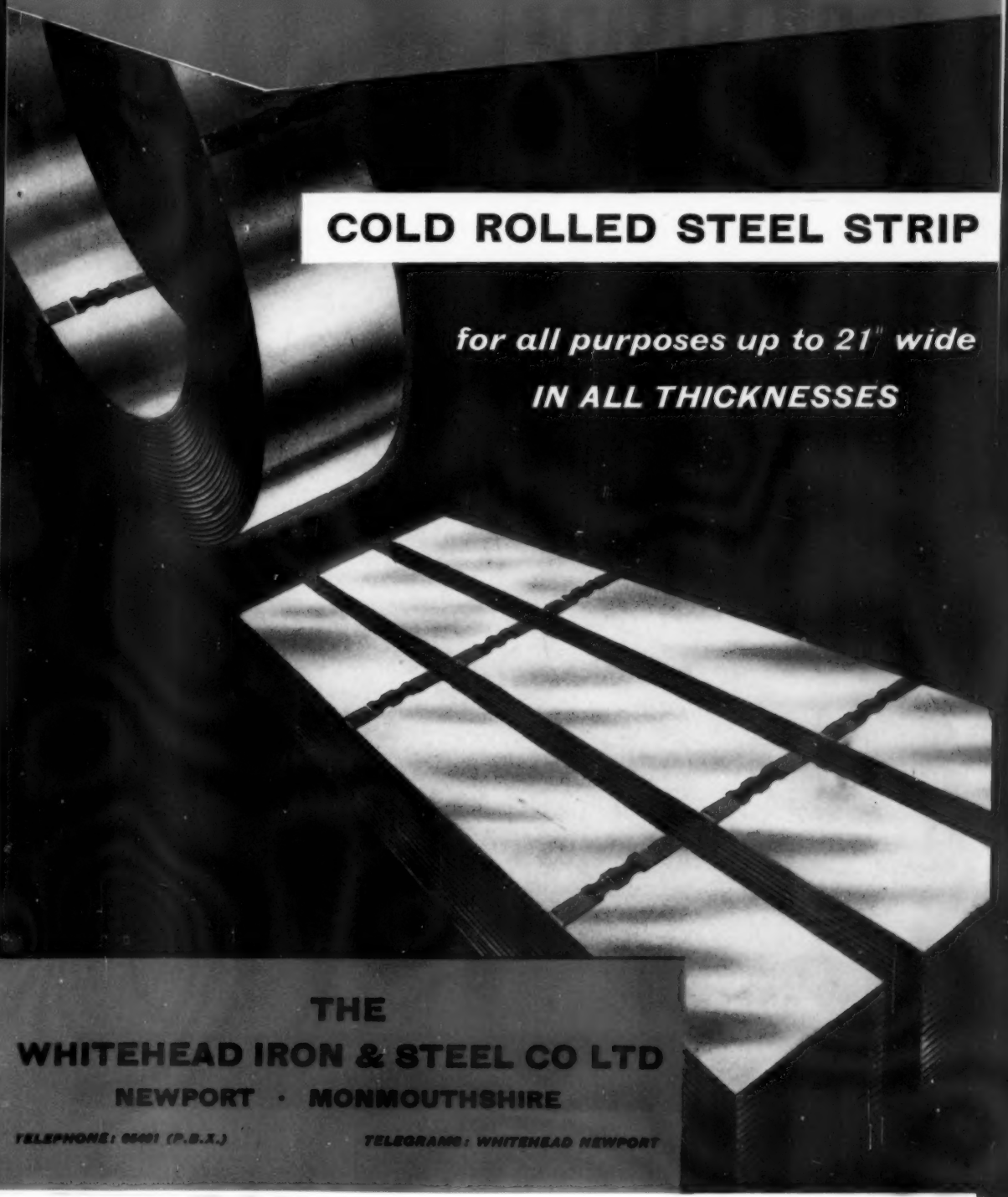
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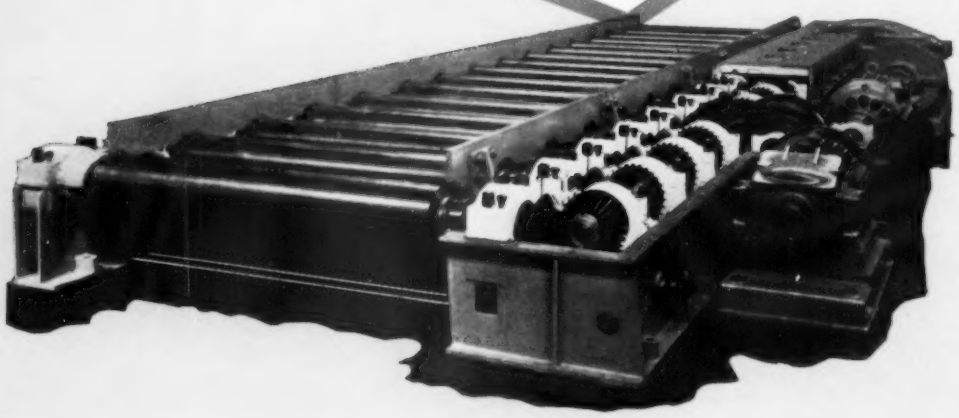
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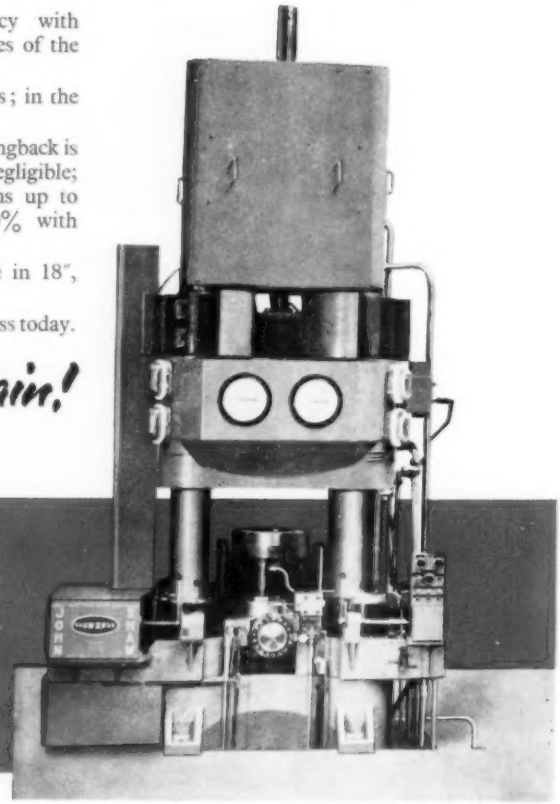
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1 Blank is placed on tool nest above forming tool.

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5 Pressure is released from flexible diaphragm and head is released.

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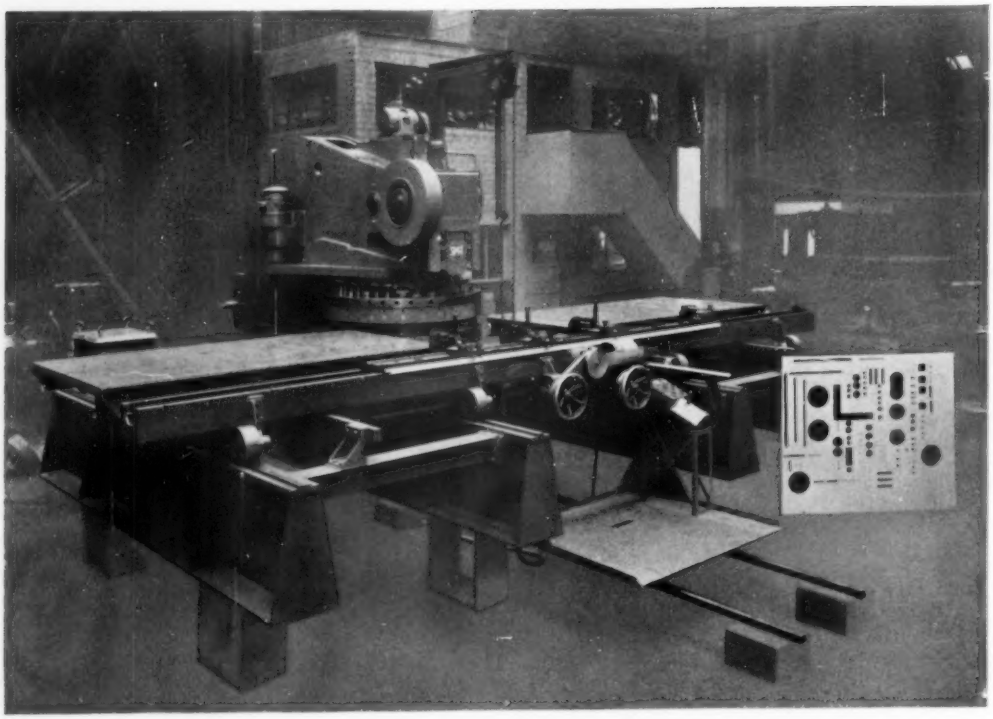


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The massive C-frame of the press, which is especially reinforced to avoid deflection, can be seen in the illustration, also the substantial construction of the table and supporting members, ensuring accuracy of positioning. At the same time easy movement is assured by mounting all rollers, etc., on anti-friction bearings.

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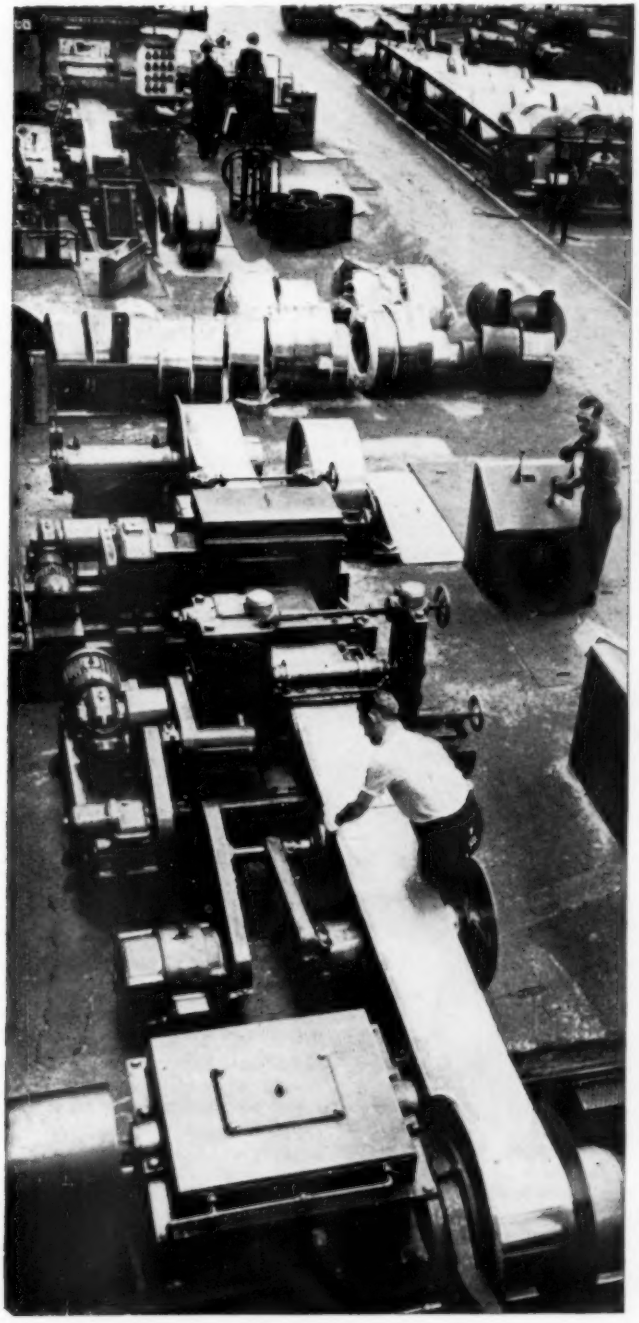
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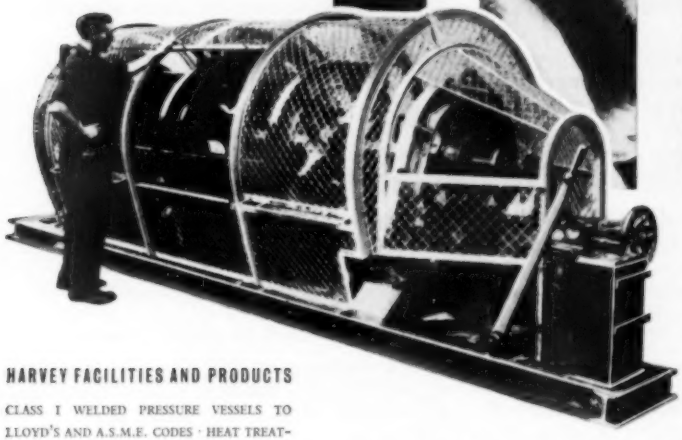
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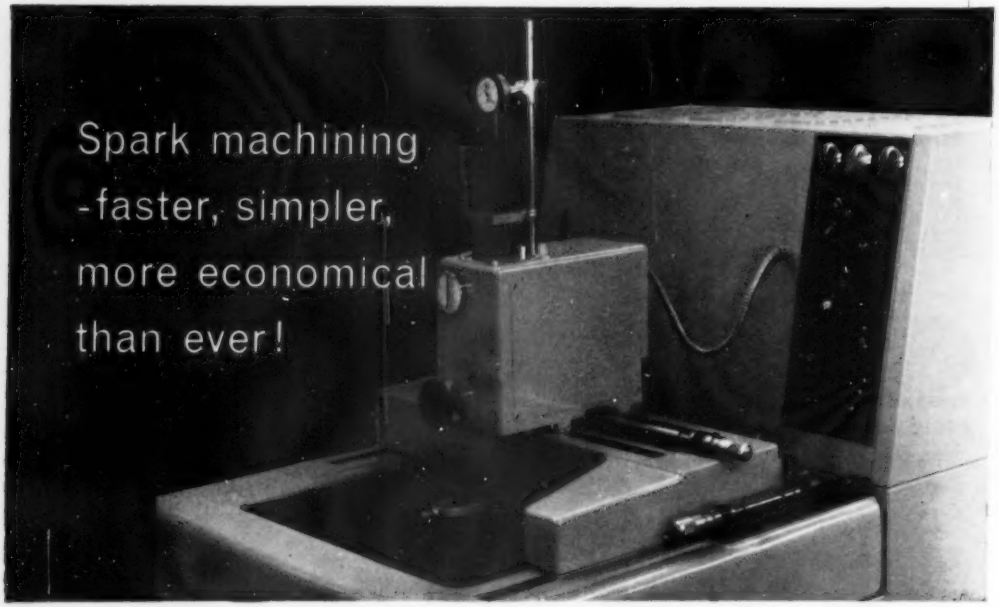
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It has all these outstanding features

Both models have a co-ordinate slide movement for rapid electrode positioning; an accurate depth stop; a dial gauge to show forward movement; an alternative work-table for extra paraffin depth.

It is compact and economical

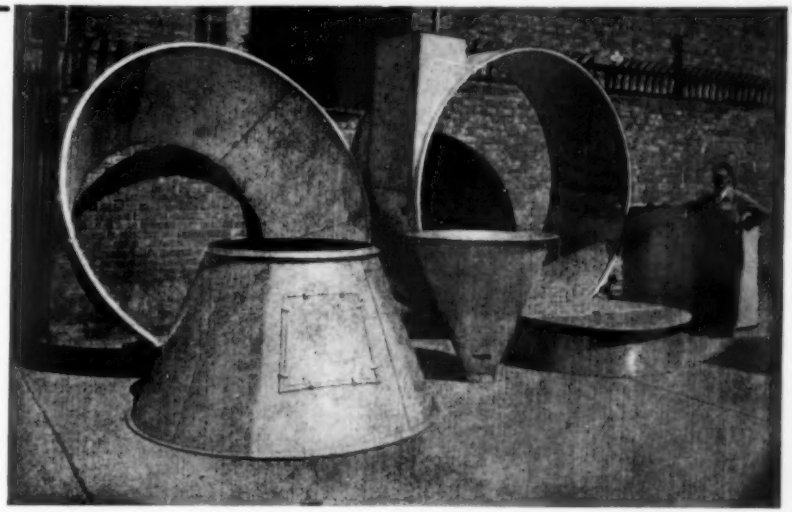
The GKN Spark Machine is well-made, sturdy and compact. All parts of it—work head, electrical equipment and paraffin system—are mounted in the same cabinet. Yet with all these advantages, installation and running costs are low.

You should know more about it

Whether you are engaged in forging, wire-drawing or press-tool making, the GKN Spark Machine is something you should know about. Write to our Sales Agents for the new brochure on:—

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Produced by Sendzimir Mill

Cold Rolled
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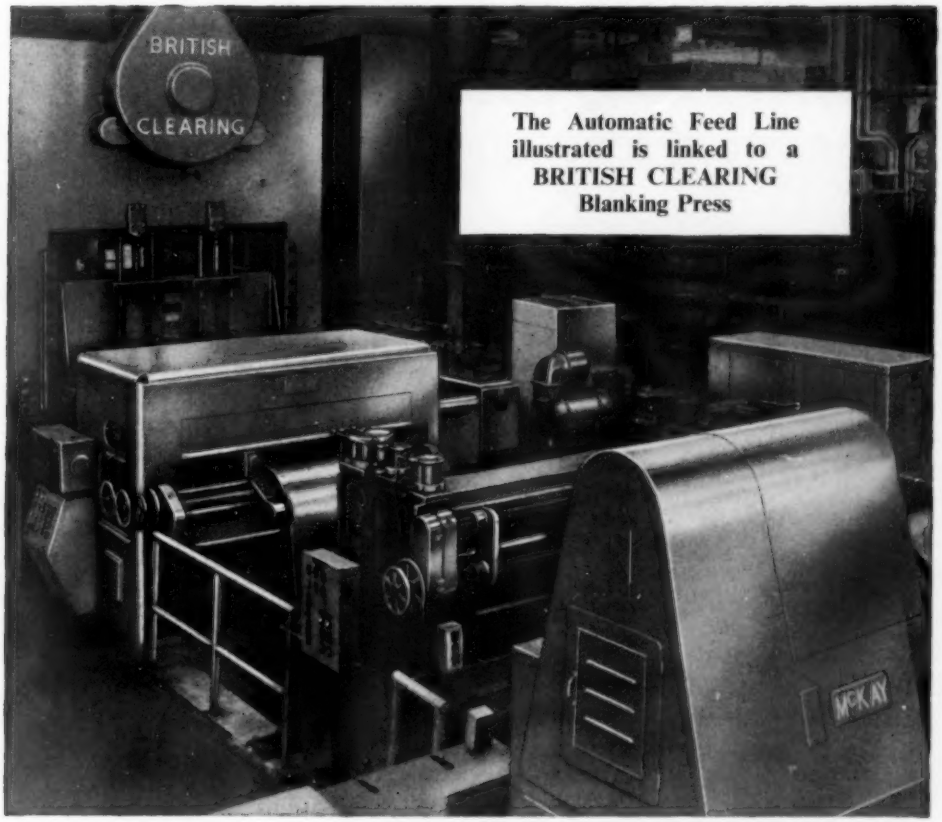
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MK3

Alas, I am undone!



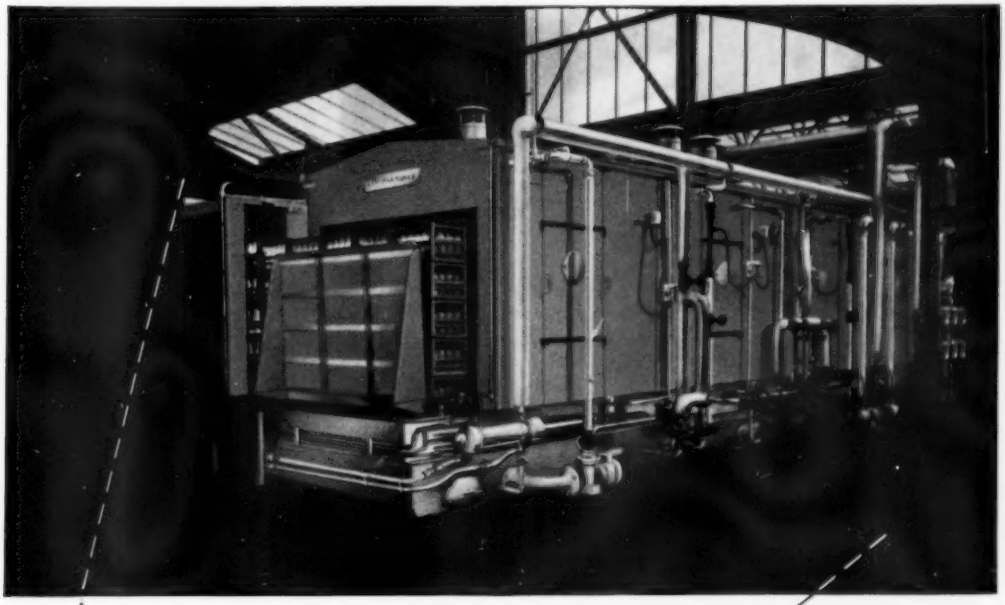
Madam—replied our well-known villain—
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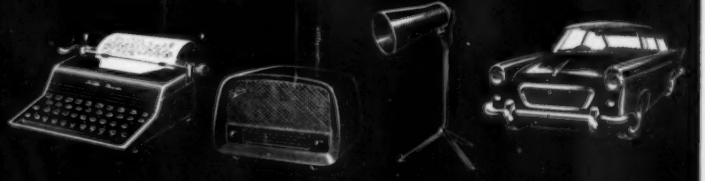
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PLASTIC COATED STEEL STRIP



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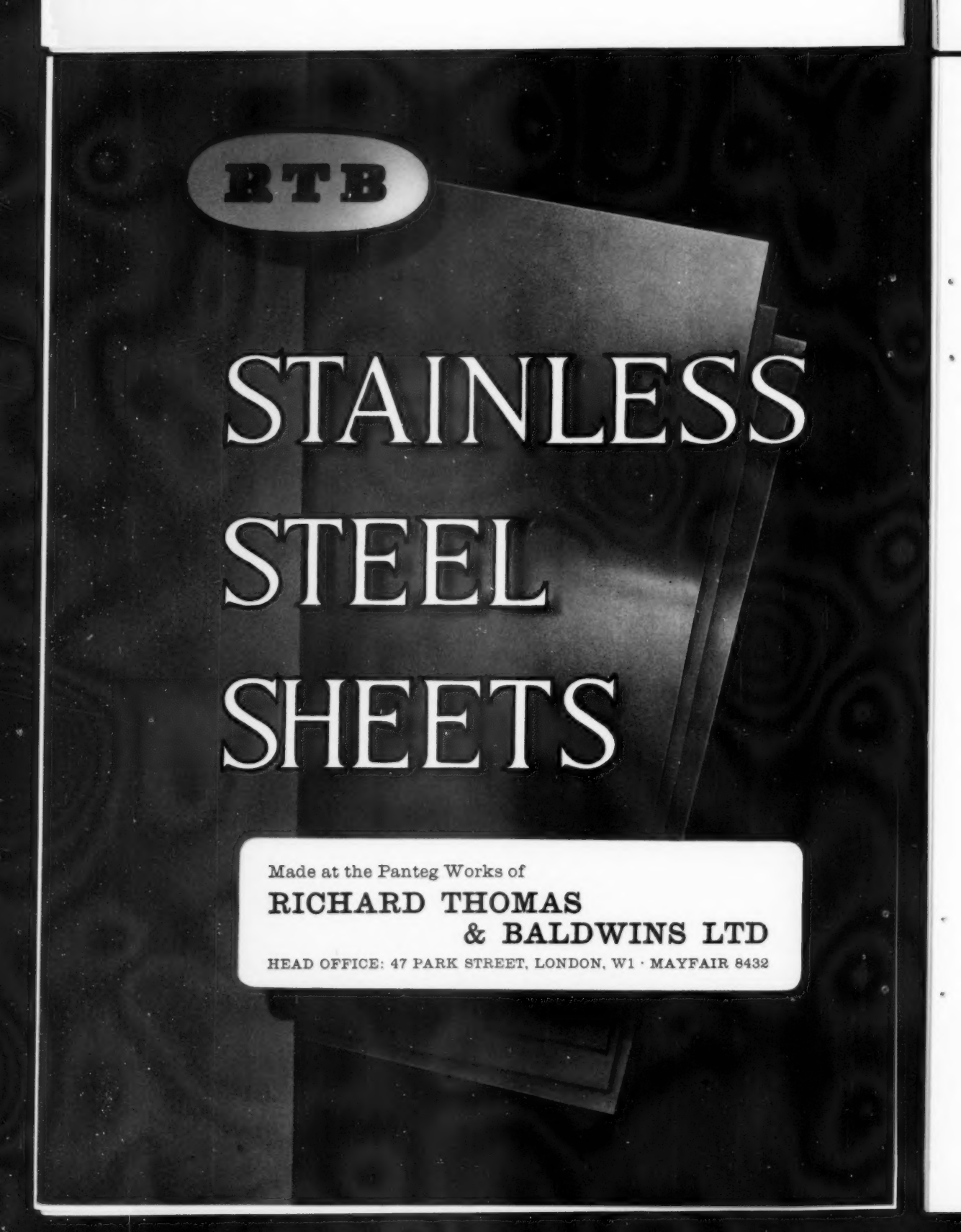
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AUGUST 1960
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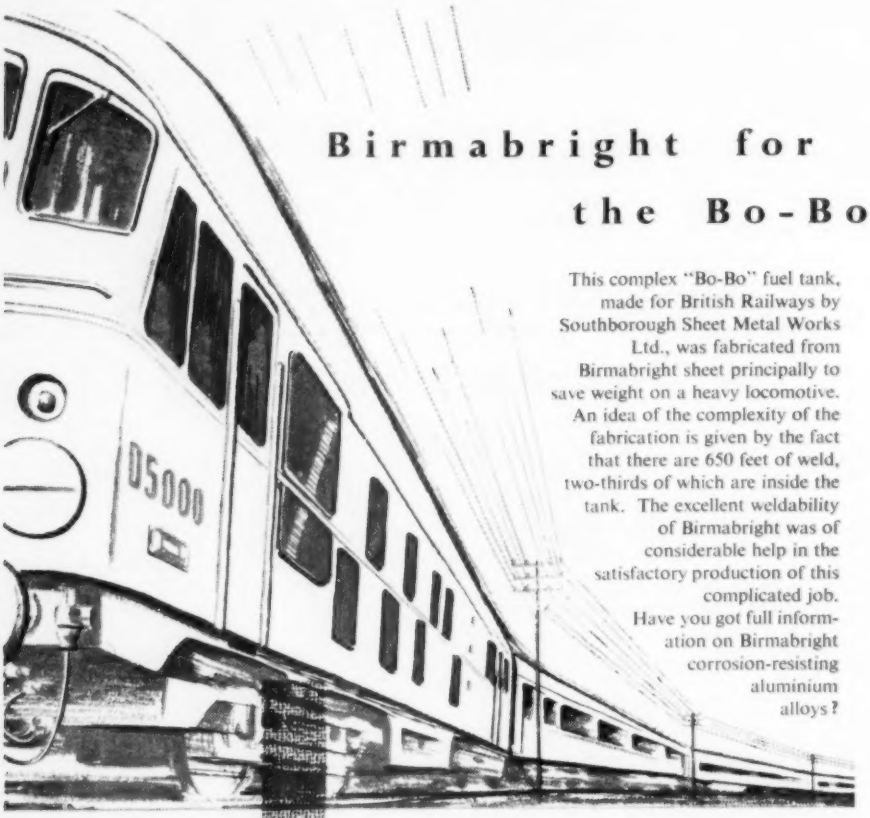
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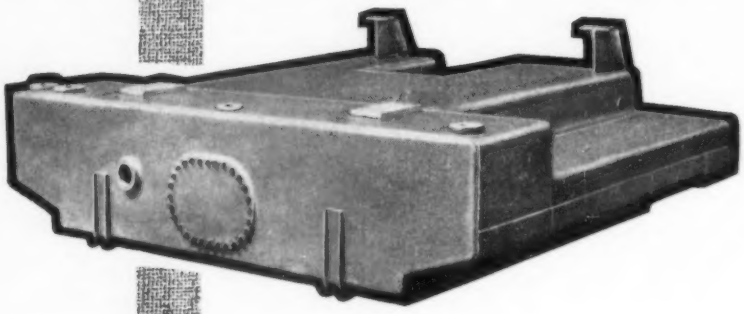
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FROM LITTLE ACORNS . . .

READING Prof. Leslie Aitchison's monumental two-volume work, "A History of Metals," one cannot fail to be conscious of the fact that during the period between 1700 and 1890 the "History" becomes almost wholly an account of British achievements, for during this period no other country was so fruitful as Britain in invention and development. In steelmaking the names of Darby, Huntsman, Cort, Neilson, Hall, Bessemer, Siemens, and Thomas and Gilchrist, are only some that are identified with this period.

From the "little acorns" of ideas of men such as these grew the "big oaks" of the present century's industry throughout the world.

It is appropriate at this time to consider the works of Sidney Gilchrist Thomas and its effect on steelmaking, for it was an original idea of this man, a civil servant, who, one is almost ashamed to say, was not given the honour in his own country that he so rightly deserved, developed in conjunction with his cousin, Percy Gilchrist, a steelworks chemist, that elucidated the mechanism for the cure for a most tiresome piece of steelmaking chemistry.

In the 1860's steel had to be made from pig irons containing both low sulphur and phosphorus using the acid Bessemer or the acid Siemens open-hearth process. It was Thomas who realized that the high phosphorus present in the pig irons readily available on the continent might be oxidized along with the carbon, silicon and manganese, producing a phosphate which could be absorbed in the slag in the same way as the silicon. To retain the phosphorus in the slag, however, it was necessary to ensure that the slag was "basic" necessitating also a basic lining to the converter or open-hearth furnace. For various reasons this development was virtually ignored in this country but on the continent the "Thomas Process" was accepted and given the attention that it deserved.

It is fair to say that steelmaking would not be in the advanced state that it is to-day if Thomas had not persevered in his aims, and his process was undoubtedly responsible for the rapid expansion of European steelmaking.

Thomas has at last been honoured in his own country, as we report elsewhere in this issue, after a period of more than 80 years, but a man such as this cannot adequately be given recognition by the erection of an obelisk. The facts speak for themselves; world production of basic steel to-day is in excess of 300 million tons per annum and is increasing, and it is worth reflecting that in spite of the high capacity of modern converters and furnaces the chemistry of steelmaking remains much the same as in the days of the invention of the basic process.

As far as our own industry is concerned, the demand for steel sheet continues apace, and Thomas's invention, in its various modern equivalents, is being used in this country to alleviate any possible shortage. A large proportion of new steelmaking capacity being installed or planned will use the latest converter processes producing low-nitrogen steel particularly suitable for sheet production. It would be a fitting tribute to Thomas to use his name in Britain in association with his process, especially now that his major contribution to steelmaking has been officially recognized.

INSTITUTE OF SHEET METAL ENGINEERING

Forthcoming Activities and Recent Events

WORKS TOUR IN SOUTH WALES

The tour of the works which has been a biennial feature of the Institute's programme since 1948, will this year be staged in South Wales. The tour will start in the Cardiff area on October 3, proceeding to the Swansea area for the next two days and concluding with visits to works in the Merthyr Tydfil area for the last two days of the week.

Companies who have extended invitations to the Institute to include their works in the tour are as follows: Guest Keen and Nettlefolds (South Wales) Ltd., Cardiff; Simmonds Aerocessories Ltd., Treforest; British Iron and Steel Research Association Laboratories, Sketty Hall; Aluminium Wire and Cable Co. Ltd., Port Tennant; Morris Motors Ltd., Llanelly; The Steel Company of Wales Ltd., Tinplate Division, Velindre; The Anglo-Celtic Watch Co. Ltd., Ystradgynlais; Hoover (Washing Machines) Ltd., Merthyr Tydfil; Lines Bros. Ltd., Merthyr Tydfil; Pilkington Brothers Ltd., Pontypool.

COLD EXTRUSION OF STEEL

TECHNICAL aspects of the production of steel components by a cold-extrusion process which were first discussed in this country at a Conference organized by the Institute in 1953, have evoked an increasing amount of interest during recent years. A further Conference on this subject has, therefore, been arranged at which papers will be presented by a number of authorities with practical experience in this field. This Conference will be held in the City Hall, Sheffield on November 21-23 next. The programme will include over 12 papers covering various aspects of the subject, and it is expected that a number of films showing the operation of the process will be shown. Typical components manufactured by cold extrusion will be on display and arrangements have been made for a visit to one or more works where the process can be seen in operation.

Detailed programmes and application forms for tickets for this meeting will be sent out to all members of the Institute and others who record their interest in the next few weeks.

TRIPARTITE CONFERENCE IN 1961

In May, 1961, a three-cornered meeting will be held in London between the Institute, the American Pressed Metal Institute and the German Forschung Für Blechverarbeitung. It is anticipated that the delegation from the U.S.A. will number about 60 representatives of metal pressing firms, who, in addition to participating in the meeting, will be visiting works of technical interest to them in the U.K. and on the Continent.

MIDLAND BRANCH WORKS VISIT

EACH summer the Midland Branch organize a visit to a leading industrial concern. The choice of the Pressed Steel Co. was obviously a happy one, as most of the party were concerned with the motor-car industry in one capacity or another.

The particular plant visited was a comparatively new one at Stratton St. Margaret, Swindon. There are already two large press shops in full production and an even bigger third one is being built to come into operation next year.

Members arrived in time for an excellent lunch, after which they split up into small groups for a tour round the factory.

The party was much impressed by the strides made in the field of mechanization, both in the press shops and assembly departments. Evidence of the success of this is the fact that the general impression was one of considerable output with a relatively small labour force.

Tea was followed by questions, which were most ably answered by members of the staff. No doubt one reason for the success of this Company is the obviously friendly spirit which prevails, which is not always present in organizations of this size.

The party left in time for drinks and dinner, more or less in that order, at Stow-on-the-Wold, and thanks are due to the Branch Secretary for organizing an excellent day out.

SOUTH-WEST BRANCH WORKS VISIT

ON June 23, 1960, a group of 24 members of the South-West Branch of the Institute visited the Hoover washing machine factory at Pentrebach on the outskirts of Merthyr Tydfil.

The assistant personnel manager gave a resumé of the history of the company and its subsidiaries culminating in the decision to introduce light industry into the heart of the coalfields.

Three senior technicians conducted the party through the batch press shop and diecasting department to the production press shop, where great interest was shown in the line sequence production and fabrication of machine cabinets from sheet to spray booth.

The final assembly conveyor was impressive for its compact layout leading ultimately to the test line where each machine is subjected to all the rigours of domestic use.

Finally, the party were entertained to tea by the management, who skilfully answered all the questions which were fired at them.

Some Aspects of the DEVELOPMENT OF TESTING METHODS FOR THE FORMABILITY OF SHEET

By drs. G. de WITTE

At a meeting in Amsterdam in 1957, sponsored jointly by the British Iron and Steel Research Association and the Swedish Ironmasters' Association (Jernkontoret), and attended by representatives of seven nations, the decision was taken to set up a Group, with the immediate limited objective of co-operating in an investigation of a Cup-Forming Test for evaluating the formability of sheet metal. The Group was inaugurated under the title of the International Deep Drawing Research Group and drs. G. de. Witte was elected its first chairman. In May of this year the Group sponsored its first major open meeting, in collaboration with the Société Française de Métallurgie, at which some 30 papers, largely relating to sheet metal testing procedures, were presented and discussed. The paper reproduced below was delivered by drs. de Witte as an introduction to the theme of the Sessions.

Introduction

THE technological tests for measuring the formability of sheet metal cover only one of the many fields of technological tests that deal with the mechanical behaviour of metal. Other examples are the tests for measuring the strength properties for constructional applications, the tests for judging the tendency towards brittle fracture under multi-axial tension at certain temperatures, and the tests for measuring creep properties. The development of each of these categories requires its own specific approach and this applies to formability tests.

However, in one respect, the development of formability tests differ from most other tests due to the fact that the information obtained by a formability test can be compared rather directly with the performance of the metal during fabrication. In contrast, the information from tests such as those related to brittle fracture will either never or only after a long statistical experience be correlated to practice. In other words, formability tests have to give information about the behaviour of the metal during its fabrication which will definitely take place at a certain moment and which must reflect the properties of the metal in a reasonably reproducible way, whereas most of the other types of tests are not concerned with the fabrication but with the application of the metal after its fabrication.

In this application the desired properties will differ from case to case and from time to time. Again in other words : formability tests apply to what *will* happen during the *fabrication*, most other tests to what vaguely is feared that *might* happen during the *application*.

From a psychological point of view, the tests on formability have a disadvantage over the other tests in that they can be checked immediately. It is much easier to develop and to agree upon a testing method when a tight check on its relation to practice is nearly impossible. However, from the technical point of view, the conditions for the development of adequate formability tests must be highly favourable. Much more striking is the fact that, notwithstanding the possibility of focusing the research directly on the press performance and in spite of several decades of research and development of testing, few people are satisfied with the currently-available testing methods !

There is a great deal of argument about what has been achieved until now. Still worse, many wonder if there has been anything achieved at all. In former times it was said that the original tensile test was very poor in predicting drawability, the old Erichsen- or Olsen- test should not be considered as a deep-drawing test and the Rockwell hardness does not say anything essential. Indeed, much development work has been carried out from this starting point, but when looking at the

actual routine testing programme of most producers and users of sheet metal, scarcely any change is observed of the types of tests in daily use, compared with the past. This poses the question whether there is something going wrong with the development of formability tests.

In view of this, some personal views will be expounded here on the problems around the development of formability tests. These views will be of a more general character, so that, when some details are used in the course of this paper, this will be done for the sake of illustrating a principle rather than for the sake of the details themselves. An attempt will be made to avoid detailed problems with the aim of *sharpening the criticism* and of an invitation to examine, every now and then during the often detailed experimental work, *what is being done* and *what is being aimed at* in the course of that work.

Without attempting to be complete, some aspects of the complicated character will be mentioned of the study of technological tests on formability, which have led to misunderstandings and contradictions in the past.

The Need for Definition of Terms; "Specific" and "General" Formability

A basic point is the definition of terms like formability, drawability, deep-drawing capacity, stretchability, ductility, etc. In many publications such terms are used as if it were quite clear what one is speaking about. An increasing accuracy is appearing in literature in this respect, however, and an analysis makes it clear that usually one of the following three alternatives is used.

The first relates the term to a given job in the press shop. Sometimes it is assumed that a group of jobs might be strongly related to each other, in which case the relation is made to that category of jobs. Occasionally the expression "*specific formability*" is used in such cases, a worthwhile thing to do, in order to distinguish from the other alternatives. In these studies, it is necessary to consider the test criteria in direct relation to the performance of the sheet in that particular job or group of jobs.

The second alternative deals with, what could be called, "*general formability*." Most metals can, in practice, be classified according to a system of "grades"; the "higher" the grade, the more difficult the jobs which can be done by the sheet, so that the general formability increases with the number of the grade. Such grades are primarily defined by the technical details of the process on the sheet-producers' side. In these studies, the tests are applied to samples of such grades in order to judge whether the testing methods assess the different grades in the right way, *i.e.*, in agreement with the grade number and, by that, in line with the "general formability" defined by the grades in question. Some comparative studies do not only deal with the assessment as such, but also with the discriminatory power of the test in assessing the grades so as to decide which test discriminates best.

The essential difference between "specific" and "general" formability is often neglected, giving rise to frequent misunderstandings. It is obvious that the assessment of metals according to a certain specific test may not be identical with the assessment by a test which happens to discriminate a certain set of grades satisfactorily. This implies that it is not possible to assess the adequacy of a *specific* test from the degree in which the test assesses different grades of sheet metal. In theory, a test which discriminates poorly between a certain set of sheet grades, can be an excellent one with regard to a certain specific formability, and conversely.

The third alternative of the use of words like formability in literature is neither directly related to the press shop nor to the assessment of grades of sheet metals, but to test values. This is, of course, fully permissible if only a clear definition is given to avoid misleading and tendentious interpretation. A danger exists, however, when such a definition is left out and when the reader is invited to substitute the formability factor concerned for something like specific or general formability as outlined before. Invitations to misunderstandings of this kind have been made in the past, presumably due to an unbalanced eagerness to propose a new testing method or new testing criteria. There even have been proposed new testing criteria on the negative base only that the new criterion appeared to assess materials differently from the known disputable criteria.

The Discriminatory Power of a Testing Method

The term "discriminating power" has been used in relation to the suitability of a testing method on general formability. It is an obviously logical approach to look out for that testing method which as distinctly as possible assesses different grades of sheet metals. The same applies to testing methods that are not aimed at assessing materials according to formability, but which are used to give information about the degree of consistency of a certain sheet quality within one shipment or one grade of sheets. In all such cases it is necessary that the test indicates any differences between the properties of the sheets with the utmost possible sharpness.

In this relation it is often said that the discriminatory power of the testing method has to be high. This suggests that this is a characteristic, a capability of the test, a suggestion that is not fully justified. Fig. 1 shows an arbitrarily chosen illus-

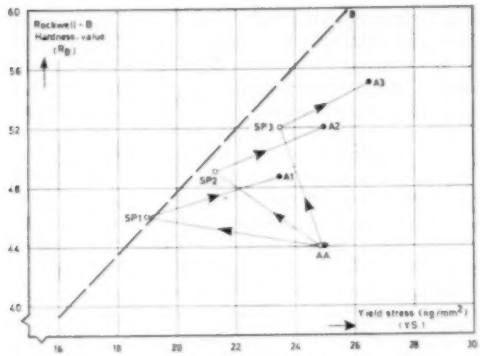


Fig. 1.—Relationships found in practice between yield strength and Rockwell hardness of low-carbon steel sheet

tration. It gives some relationships found in practice between two often used test values for low-carbon steel sheet, *i.e.*, the yield strength and the Rockwell hardness value. Point AA gives the combination of both values for a sheet of rimming steel in the annealed condition after cold reduction. By a small cold reduction of about 1 per cent on the skin-pass mill, AA moves towards SP_1. By the application of a 2 per cent and 3 per cent skin-pass reduction instead of 1 per cent., AA moves in different directions towards SP_2 and SP_3. Strain-ageing during six months at 20° C. subsequent to the three skin-pass cold deformations move the points SP_1, SP_2 and SP_3 in new directions towards A_1, A_2 and A_3 respectively. Another " relation " between both test values is given by the dotted line. It shows the average relation as it happens to occur for a grade of sheet steel in the 1 per cent skin-passed non-aged condition. It is noticed that the slope of this relation again differs from all former ones.

The figure not only gives an illustration of the well-known fact that there does not exist one uniform relation between two different test criteria, even for one type of product (a sheet of a certain thickness) made from one lot of metal (a certain grade of steel), but it illustrates also *the impossibility of comparing the discriminatory power of different test criteria in an absolute sense.* The result of an incidental comparison of discriminatory power will depend upon the sheet metals on which the study is carried out. This must be the explanation of many contradictions encountered in the literature and it stresses the danger of generalization and of extrapolation of results besides the limitation of the experiments themselves.

The fact that the ability of a testing method to discriminate between sheets with different properties depends upon the test as well as upon the characteristics of the sheets involved, proves that it will be impossible to develop one universal method of testing general formability with an adequate discriminating power for all metals at the same time and, for a given metal, for whatever system of grades. (This conclusion must be of great relief to the manufacturers of testing machines who can depend on a great variety of mechanical testing methods, each of them satisfying somewhere with regard to discrimination.)

It is worthwhile indeed, to stress the point that the development and the appreciation of such a test must be strongly related to the particular group of metals in view.

This statement must be in evident contradiction to what is to be expected about *specific testing methods*. The ideal specific test must be valid for any sheet metal of the same thickness. Conversely, by including different metals in the same study of comparing test results with press performance, useful information may be obtained about the specific character of the testing method.

The Analytical Approach ; the Basic Meaning of a Test Value

Before bringing some other aspects of the study of specific testing to the fore, a separate approach on formability problems has to be mentioned. This approach does not envisage the direct " measurement " of either general or specific formability by means of a testing method, but tries to find out the basic components of mechanical behaviour of the sheet by analysis. If possible, it would be preferable indeed to work with the basic or fundamental characteristics which finally define the actual behaviour of the metal when it undergoes the deforming treatment. If knowledge in this respect was sufficient, a number of analytical tests, each revealing one or more basic properties, could either be used as an alternative to the numerous technological tests or at least be of great help in the development of such tests. The analytical approach along such lines has to be stimulated as far as possible. It is only for the sake of limitation that further thoughts will not be given here on this very particular search for basic characteristics and for analytical tests to measure them.

Confining the discussion to technological testing, an analytical attitude is also encountered in literature on the technological level, for example, by analyzing the deformation of a blank into a cylindrical cup into components like symmetrical stretching, bending-and-unbending, wedge-drawing and friction, an approach which requires undivided attention indeed, and which already has led to better understanding and formulation. Others try to find out whether a combination of test values might give better correspondence with press-shop performance, whereby the weight of the test values in this combination may be different for different applications under the press.



Fig. 2.—K.W.I. hole-expanding test

Such work is of the same atmosphere, although of a less basic character of course than the above-mentioned fundamental analysis.

It is necessary to observe great caution in the decision whether a testing value gives basic or techonological information. A fundamental characteristic can be defined as a characteristic of which the value does not depend on the way in which it has been determined. In this respect many quality factors have only a basic character instead of being a fundamental characteristic. The yield strength, the ultimate strength and the uniform elongation as measured by a tensile test are samples of this kind.

Experience even seems to show that a generalization of the answer whether a test value has a basic character or not may be hazardous.

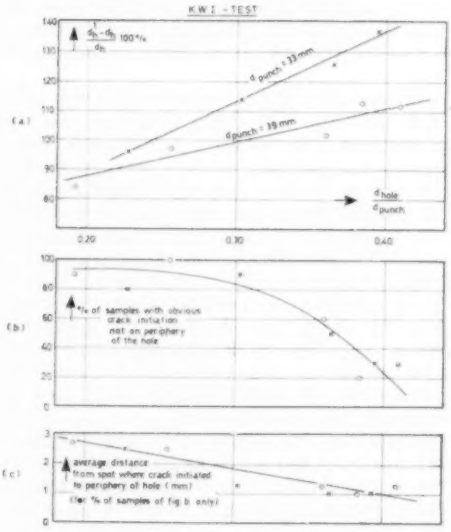
An example of this nature was met in a study of the K.W.I. hole-expanding test. This well-known test aims at measuring the maximum elongation of the metal fibre situated at the periphery of a hole. If an ideal production of the hole is possible such that any disturbance of the characteristics of the sheet metal around the hole is avoided, it seems justifiable to assume that the test will, in fact, give information about the ductility of the metal at the edge of the hole.

However, Fig. 2 shows what may occur. It is clearly shown that the cracks do not always initiate at the periphery itself but at a small distance from the edge. At first glance it looks like the effect of disturbance of the ductility of the metal through the grinding and polishing action needed for the preparation of the blank.

More careful examination of the behaviour of the steel sheet in question, suggests, however, that such a hypothesis does not satisfy. Fig. 3 gives more details about what has been found. Fig. 3 (*a*) shows that the degree of expanding is visibly dependent on the diameters of the original hole and of the punch. This feaure seems to contradict the assumption that the ductility of the edge material, work-hardened by the preparation of the hole or not, is measured by the test. In Fig. 3 (*b*) the percentage of samples is given, in which the crack initiation obviously did not take place on the edge. This percentage decreases with increasing ratio of hole-diameter and punch-diameter and seems, in the first approximation and within the limits of the experiment, to depend on this ratio independently of the absolute dimensions of the hole and the punch themselves. As Fig. 3 (*c*) demonstrates, the average distance from the spot where cracking began to the edge of the hole, decreases together with the probability that the crack does not start at the edge.

It is suggested that the phenomena just described lead to the conclusion that the testing method does not guarantee an exhaustion of the ductility of the edge material. A blank without a hole in the centre would have shown its rupture somewhere on the radius of the punch. The insertion of a very small hole in the centre will not alter this picture severely. By increasing the original diameter of the hole, it has not to be assumed now that the spot of crack initiation will move discontinuously from the punch radius area to the edge of the hole. The actual position of the spot where rupture starts will depend on the strain pattern in the blank in detail,

Fig. 3.—Graphs showing results of investigations into K.W.I. hole-expanding test



a pattern which will be a function of both testing variables and sheet characteristics. This has to be considered as a striking example of the thesis, *that the basic meaning of a test value does not depend only upon the details of the testing method only but also upon the characteristics of the tested material.*

A peculiar and intriguing consequence of the complications just described with regard to the K.W.I.-test is, that under " favourable " conditions, the testing method will discriminate between certain materials very well. If the conditions for one material are such as to permit the ductility of the edge to be exhausted, whereas this does not apply to the other material, the hole-expanding values may be very different. In such cases the test discriminates very distinctly and can be considered as a first-class technological test. However, the conclusion that both materials show a very different ductility value ought to be avoided if no further evidence of that is produced. Furthermore, the test might discriminate poorly under " unfavourable " conditions for the same reason. The same kind of conclusion may be valid for other testing methods as well.

Sampling and Press-shop Interpretation

The study of the development of real specific tests has its own particular complications of which some have already been mentioned with regard to the testing method itself. But that is not the only item which has to be considered. To prove the adequacy of a given test as a means of predicting the behaviour of the metal in a particular job in the press shop, two other sets of problems have to be overcome.

First, there is the sampling problem. When a given batch of sheet metal has to undergo pressing, how has it to be sampled for testing in order to ensure that the test result can be considered as a representative information about the quality of the whole batch ? Is it permissible in all cases to attribute a certain level of quality to a sheet ? Do there exist cases in which a sort of mixture of quality levels with a certain average value and statistical spread has to be recognized instead of one certain quality level ?

Questions of that kind are related to the possible inhomogeneity of the sheet and have to be considered very carefully. Quite distinct from the difficulties that usually arise through lack of adequate model theories—a complicating problem which will not be dealt with here—it must make a great difference whether a batch of wide sheets of rimming steel is used for the production of thimbles or of large bath-tubs which each will take the full width of the sheet. In first approximation, the thimbles will consider the sheet as a material consisting of parallel zones of quite different properties, whereas the bath-tubs will not. Again, how to sample in both cases ? For the time being, the answers will have to be based upon presumptions rather than upon insight.

The second type of problems concerns the interpretation of the result in the press shop. Three possibilities may occur in the first instance :—

(*a*) The pressing runs faultless without any difficulty after the first adjustment of the press ;

(*b*) It appears to be possible to avoid failures by adopting the adjustment of the press every now and then, and

(*c*) Failures occur notwithstanding continuous adjustment.

This does not provide a fully continuous criterion on which to assess the sheet materials, so that it is questionable whether the pressing assesses the materials in an adequate manner. One may have luck or not. Besides that, it is not always possible to avoid subjectivity in the interpretation. In any case, the results will be affected by the condition of the press and the tools, by the adjustment possible on the press and by many further details like lubrication, etc. Because of these complications, it will often be advisable to extend the experiments to obtain more statistical than incidental kind of study.

When failure occurs during pressing, it is very important to consider whether the failure is due to press or tool conditions, or to the sheet metal itself although an answer to that may be very difficult. In the latter case it is necessary to try to find out whether the sheet has failed by a typical local inhomogeneity or discontinuity, or by the so-called normal fluctuations of the metal characteristics over the whole batch. This is an important question seeing that the testing method is supposed to give information usually about the latter item only.

The critical points mentioned about sampling and interpretation—there will be still more of this kind—must be taken into account in the setting up, in the carrying out and in the interpretation of experimental studies about specific tests. If the work is not done in a very careful way, the result may be misleading and might do much harm to progress in this interesting and important field.

Relative Character of Information by a Specific Test

To conclude this paper, an intriguing point of view will be given about the possibly relative character of the information by a pure specific test. This will be done on the light of some experience obtained with cup-forming, although the qualitative result might as well apply to other methods of metal forming.

Fig. 4 gives a qualitative picture of what must be the background of the probability of rejection in normal cup drawing. As known, the *maximum* punch load effected during the draw increases with

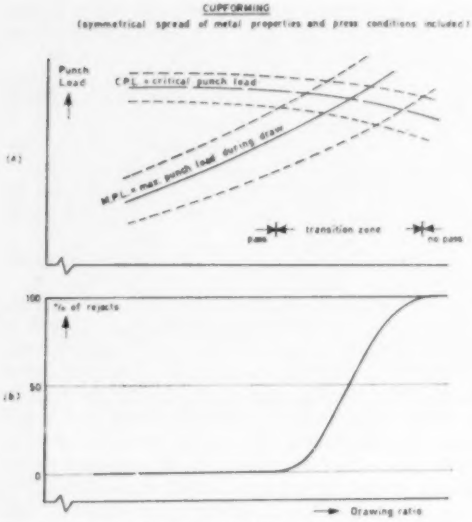


Fig. 4.—Graphs showing probability of rejection in normal cup drawing

the drawing ratio. Due to spread of both mechanical properties of the sheet and drawing conditions, this M.P.L. will show some scatter as indicated. For each drawing ratio a certain mean *critical* punch load can be defined, rather paradoxically, indicating at which punch load the blank would have failed by rupture somewhere around the radius of the punch.

Within the zone where the two scatter bands of M.P.L. and C.P.L. cross each other, the situation may occur for certain blanks that the M.P.L. figure is lower than the C.P.L. figure. This means that the blanks concerned fail during the draw, so that the number of rejects increases from negligibly small to nearly 100 per cent by passing the zone, indicated as the " transition zone," from left to right.

This shows that even *different* materials can have transition zones situated around the same drawing ratio, if only the mean M.P.L.—and C.P.L.—lines intersect at the same value of the drawing ratio. Fig. 5*a* shows a hypothetical example of three different metals which meet this condition. Although in such a case the so-called " Limited Drawing Ratio at 50 per cent reject " must be the same for the three materials, it is not yet sure whether the three S-curves, showing the increase of rejects with drawing ratio, will coincide completely. This must depend on factors like the angles at which the C.P.L.—and M.P.L.—lines intersect for each material and the degree of scatter of the C.P.L.—and M.P.L.—values. In Fig. 5*b* it is assumed that the width of the transition zone can be different.

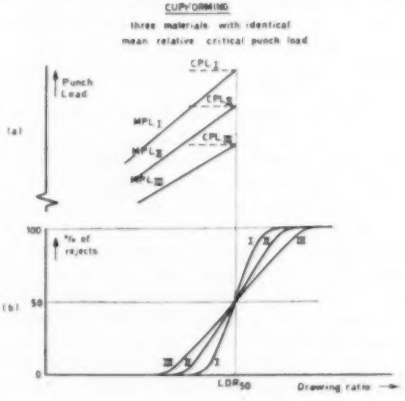
Such a hypothesis would imply that, in comparing the quality of different materials with regard to their capability for cup forming, the answer may depend upon the working point. In the case as supposed in the figure, the three materials are of the same quality according to the value of LDR_{50}. For LD ratios corresponding to lower percentages of rejects, material I is the best and material III the worst. For those regarding high percentages the materials are ranked in the opposite sense.

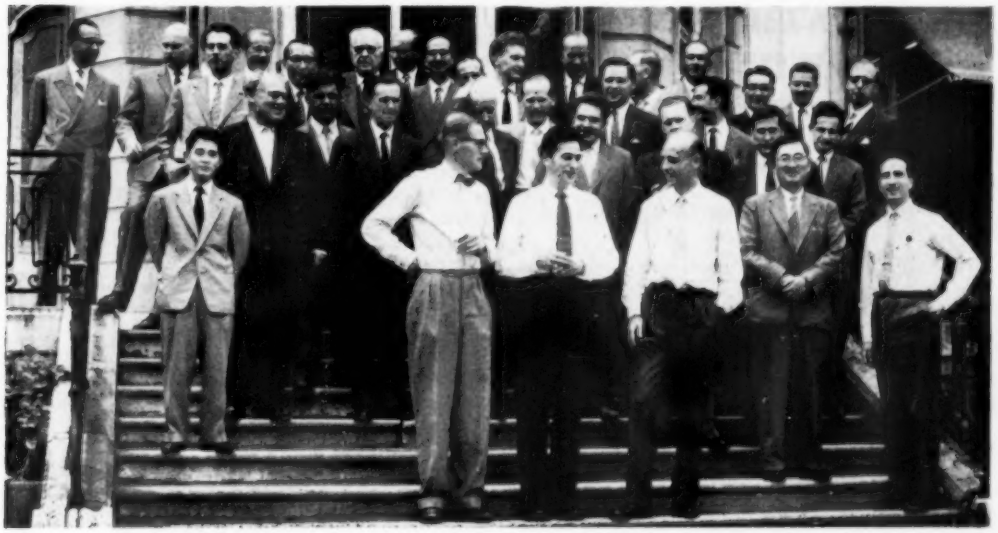
Cup-forming experiments, not yet reported, have been developed by the author to estimate LD ratios even at negligibly low percentages of rejects. They seem to justify the conclusion indeed that at some drawing ratio the ranking order of two materials may be reversed. Such a turn-over point can be situated either within the practical transition zone, in which case it is generally said that the cup-forming test does not discriminate, to the left or the right of that zone.

The consequence of this must be very important. At the present time it has not yet generally been proved whether cup-forming tests can be considered as adequate specific tests for certain larger pressings in practice of the same type. It is, however, definitely logical to consider the test as a specific one with regard to the press shop that uses the testing machine itself for production purposes. The experiments mentioned do show that, if materials are tested at certain drawing ratios which are different from the actual drawing ratio used in the press shop, the information provided by the test may be completely wrong. This does not mean an overriding criticism of the cup-forming test as such. It is pointed out, however, that caution is required because a turn-over point may exist

(*Continued in page* 571)

Fig. 5.—(a) Hypothetical example of three different metals with same relative critical punch load. (b) This graph assumes that the width of the transition zone can be different





The meeting of the Council of the International Deep Drawing Research Group which followed the joint Colloquium was held by invitation at the laboratories of IRSID at St. Germain en Laye. The delegates of the eight member nations are shown here with, in the foreground, the three officers of the Group, (left to right) drs. G. de Witte, immediate past chairman, Dr. S. Garber, hon. secretary, and Prof. C. Crussard, chairman

Some Aspects of the Development of Testing Methods for the Formability of Sheet

(*Continued from page* 570)

somewhere in the order in which different metals are ranked by one and the same testing method.

Conclusion

Some personal views of a general character have been given about the complicated nature of the research on formability-test criteria. It was not intended to do so in a negative way so as to become intimidated by the complexity of the work. On the contrary, it is hoped that a contribution has been given to clear up many seeming contradictions in opinions and experiences. The character of the research obviously requires great caution. A note of warning must be given against *oversimplification, generalization, lack of definition of terms* and *lack of demarcation of the subjects*. The author has not answered the question " what is going wrong on the development of technological formability testing methods," because of the highly coloured, negative character of that question. If he was asked to formulate positive advice to the benefit of that development this advice would be based on three items, partly of a philosophical nature and identified with the conscience of the investigator :—

(1) It is worthwhile to ensure that a contradictory or negative experience may not be due to a *wrong posing of the question.*

(2) Finding out *the demarcation of the validity* of a result (a testing method) is to be preferred to being content with *criticizing the result* in a certain respect.

(3) It appears useful to be aware of the *possibility* that many questions, which are still open now, may be answered or eliminated *sooner* by careful examination of the experience gathered by the existing technological testing methods than by proposing new ones.

Acknowledgement

The author wishes to thank the management of the Royal Netherlands Blast Furnaces and Steelworks Ltd. and of Breedband Ltd. for permission to make use in this paper of experience gathered by the author in his functions at those works.

Honour for C. and G. Chairman

THE Albert Medal of the Royal Society of Arts for 1960 has been awarded to Sir Frederick Handley Page, who is chairman of the City and Guilds of London Institute, "for leadership in the design and manufacture of aircraft."

AUTOMATIC CONTROL OF A WIEDEMANN TURRET PRESS

Details of a System Developed by The General Electric Co. Ltd.

WIEDEMANN turret presses are employed at the Witton Works of The General Electric Company Ltd., to punch out the sheet steel panels used in the manufacture of indoor switchgear cubicles. A typical press is shown in Fig. 1. These panels are punched with a series of standardized apertures corresponding to the instruments, relays and accessories fitted to the switchgear cubicles. For many years presses of this class have been operated manually, and the decision to develop an automatic system of control was influenced by the fact that the operators tired rapidly from the strain of continually watching the scales which indicate the position of the panel relative to the punch.

The task of devising an automatic control system was assigned to the Control Engineering Group of the G.E.C. Research Laboratories at Wembley, and in conjunction with engineers at Witton Works, an efficient and reliable control system was evolved which was put into commission early in 1959. The new system makes use of teleprinter punched tapes to initiate electrical impulses which are translated into machine movements by means of telephone relays. Before describing the details of this system it will be of interest to review the method of operating the press under manual control.

Manual Control

The Wiedemann press used to punch the panels has a capacity of 71 tons and is fitted with a turret containing 32 punch and die sets of various shapes, together with an air-operated centre punch, making a total of 33 stations. Any of these stations can be positioned under the press ram by rotating the turret. The top portion of the turret carries the punches and the lower portion the dies; each is driven by separate chains from a common shaft and is locked in position by a sliding pin registering with the frame of the press.

The machine table is capable of carrying a plate of maximum size 10 ft. × 5 ft. × $\frac{1}{4}$ in. between the upper and lower portions of the turret. The table is provided with two movements, one of which moves parallel to the machine axis ("Y" direction) and carries the other which moves at 90 degrees to the Y direction and is labelled "X" direction. The plate is attached to the X direction slide by four clamps any one of which can be retracted when it approaches the turret, thus allowing the full area of the plate to pass through the turret.

The slides are positioned by two handwheels to which are attached measuring scales marked in

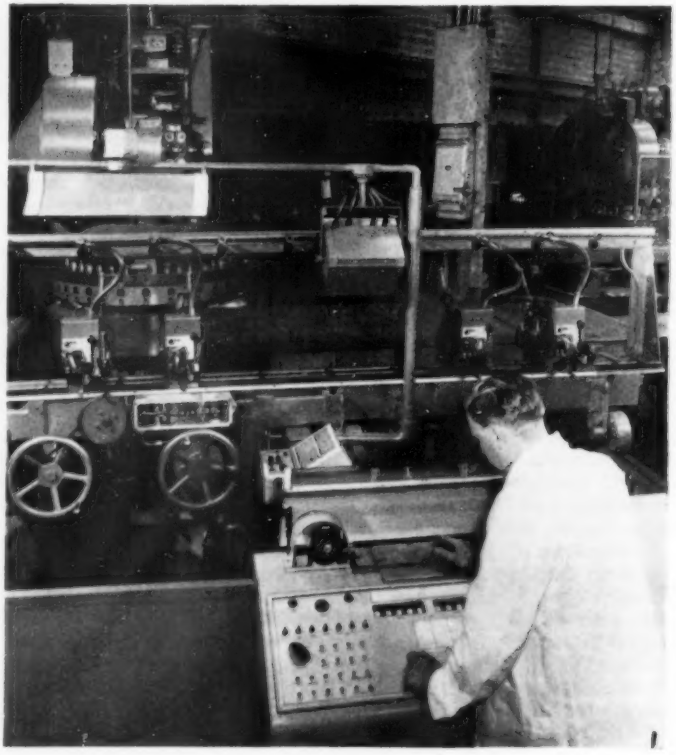
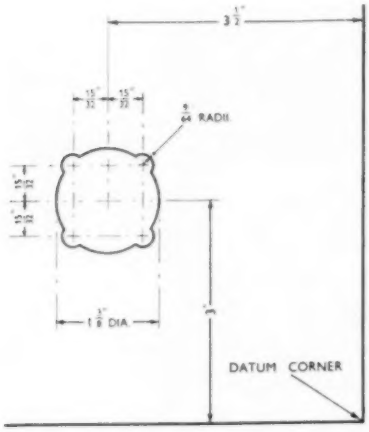


Fig. 1.—Wiedemann turret press with automatic control



STATION	Y. DIRECTION	X DIRECTION
04	3·469	3·969
		3·031
	2·531	
		3·969
10	3·00	3·50

MANUAL



AUTOMATIC

Fig. 2.—Manual and automatic programme instructions for a typical aperture

increments of $\frac{1}{16}$ in. which cover the full movement of the slides; vernier scales enable the required dimensions to be set to $\frac{1}{64}$ in. The operator stands on a platform which is attached to the Y direction slide and hence moves in and out with the component. The handwheels and the push-buttons for actuating the ram and the turret are positioned so that they can be operated from this platform.

The operator is supplied with a chart showing the station number and the X and Y co-ordinates for each punch stroke. This chart is compiled by the programmer who converts the component drawing into this form (Fig. 2).

Automatic Control

For the automatic scheme, punched paper tape (standard 5-hole teleprinter-type) was chosen for programming the instructions to the press, and it was decided to employ digital control throughout, using the well-tried P.O. type 3,000 relay, together with a number of rotary switches. Two small d.c. motors were fitted to drive each table movement, giving 3-speed control, and the induction motor driving the turret was replaced by a 2-speed d.c. motor. A simplified schematic diagram of the control scheme is shown in Fig. 3.

When the press is under automatic control, a tape, carrying the information for punching a complete plate, is run through the tape reader. The perforations are read in discrete phrases and each of these is decoded by a set of relays which check the reading and route the information to the appropriate set of rotary switches. There are three sets of rotary switches, one for the turret and one for each of the table movements; their function is to store the next required movement. When the previous punch stroke has been completed, the three movements take place simultaneously under the control of the rotary switch sets and the associated motor control relays. The actual turret and table positions are fed into the rotary switch sets continuously from digitizers, Fig. 4, whose function is to convert the positions to an electrical code to an accuracy of $\pm$ 0.01 in. As the desired position is approached, the motor speeds are reduced, and when

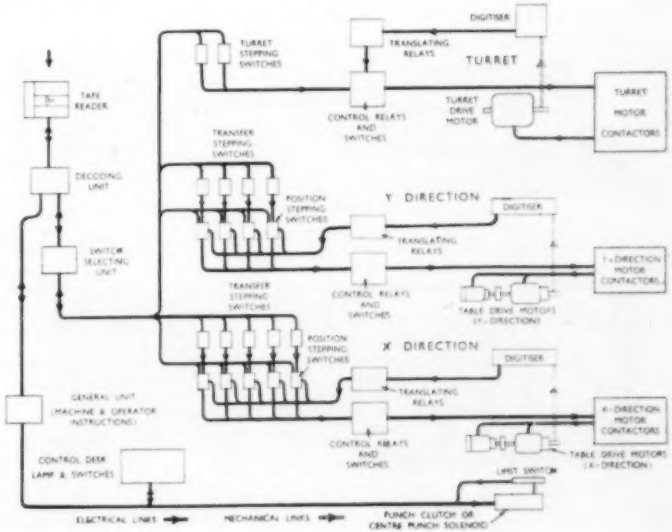


Fig. 3.—Simplified schematic diagram of automatic control scheme

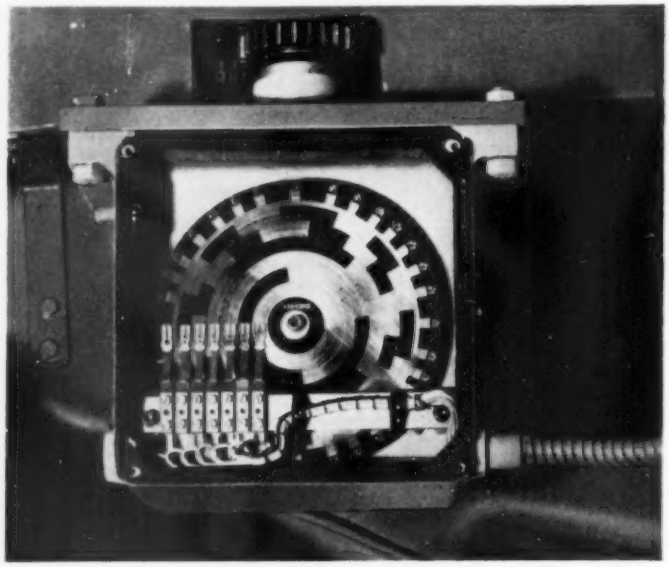


Fig. 4.—The turret digitizer mechanism

the position signalled by the digitizer coincides with the desired position, the corresponding drive is switched off and a brake applied. When all three movements have finished, a signal actuates the punch. Adequate interlocks and circuits are provided to minimize faulty operations of the system.

Punched-tape System

The tapes are produced on a "Creed" teleprinter which gives a red visual typewritten record with the punched tape as the by-product. When sub-routines are added or alterations are made to the master tape a Creed transmitter is utilized, the output of which is passed to the teleprinter, which then gives a black-printed record. By this means information added from the teleprinter keyboard is distinguishable from that added by the transmitter, and a changeover from one to the other is very easily carried out.

The information required on the tape for setting the machine and actuating the punch ram consists of a turret movement code followed by two decimal digit codes, a Y movement code followed by four decimal digits, an X movement code followed by five decimal digits, and the punch code. Each of these codes occupies one line accross the tape and is made up of a combination of up to five holes. These combinations are grouped for easy recognition; a four-hole combination denotes a movement code, two holes denote a digit code, while a combination with an odd number of holes denotes a subsidiary operation such as an operator's instruction. These odd-number combinations are preceded by the letter code. The grouping provides a means of checking the movements and their digits while the tape is being read. The letter code cancels out the checking circuit when an odd-number combination is read. One whole setting occupies 1½ in. of tape, but should a movement not need to be altered, it is not punched into the tape

(*Continued in page* 586)

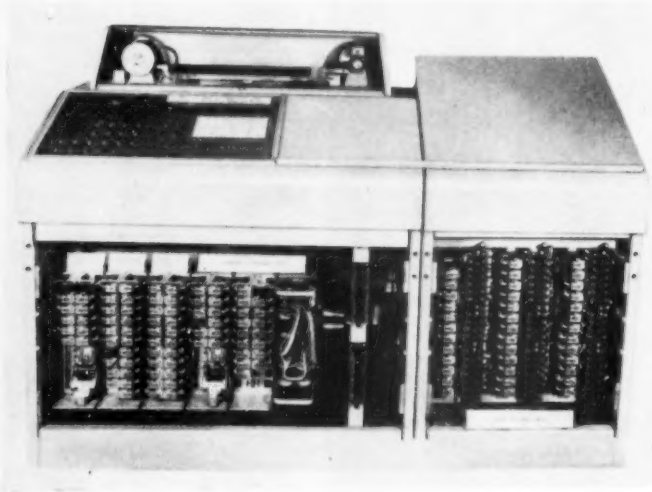


Fig. 5.—Front view of control desk showing arrangement of relays

RUBBER-DIE PRESS FORMING OF ALUMINIUM AND ITS ALLOYS

By G. FITZGERALD-LEE, F.R.Econ.S., M.I.E.I., A.R.Ae.S.

Dies and Tools

DURING the Second World War the rubber-die press was used mainly in the aircraft industry, partly because it is so suited to the production of many aircraft components but also because the shortage of rubber restricted its application to essential industries.

The possible field of application is, however, very wide and in present conditions it could be used, especially in view of the several excellent plastic "rubbers" now available, with advantage in many industries, such as electrical trade pressings, radio parts, engineering sundries, toys and novelties.

Simple forming, blanking, piercing, shearing, flanging and drawing may all be carried out with the rubber-die press with simple and thus relatively inexpensive tools.

The rubber press consists essentially of a thick rubber pad housed in a steel container strong enough to withstand the maximum pressure exerted on the press platen, the thickness of the rubber being about two-thirds the depth of the container.

Dies made from hardwood, zinc alloy or steel are placed on the surface of the platen, the sheet material to be formed being positioned on the dies by suitable location pegs. As hydraulic pressure is applied the movement of the platen forces the dies and the sheet material against the rubber pad which, when deformed, compels the metal to shear, bend or form to the shape of the die.

Until recently it was generally accepted that the use of rubber in conjunction with press tools was dependent on the ability of the rubber to flow, that is, when pressure was applied to a quantity of rubber placed in a closed vessel or container a resultant reaction was set up on every surface with which the rubber came into contact. At the same time it was noted that, in contrast with a purely fluid medium like water, rubber possesses the property of cohesion, or resistance to free flow.

Now, however, it is believed that the fluid-like flow of rubber is almost inappreciable and that it is the frictional properties of rubber that are decisively important in forming components by the rubber-die press.

In other words, the ability of the rubber under pressure to react and to form sheet-metal parts is due to the resistance of the rubber to deformation. The pressure obtainable is limited by the shear strength of the rubber; once the rubber begins to shear the pressure concentration falls so rapidly that completion of the operation is impossible.

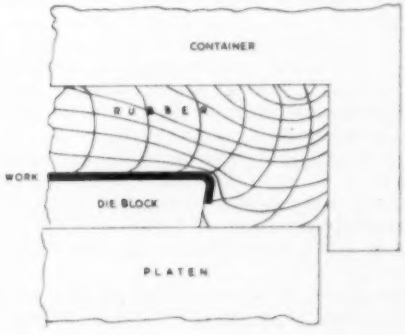
The frictional properties of the rubber also have considerable influence on the working action of the rubber pad since the process is a dry one, achieved by a combination of stretching and displacement.

Very little slip takes place, and what does is over vertical surfaces, never over horizontal, as may be shown by placing spots of wet paint upon the metal to be deformed; it will be found that they are transferred to the face of the rubber pad without appreciable smearing.

The face of the rubber clings by friction to the metal blank at the point at which it first touches the blank and remains at that spot even when full pressure is obtained, the more distant parts of the rubber pad being displaced and stretched over the work and the dies on which it is being formed. This action of the rubber is shown in Fig. 1.

Although most modern rubber-die presses have

Fig. 1.—Action of rubber pad under compression



been designed for use with high pressures, a considerable amount of work on sheet of from 14 to 20 s.w.g. is produced on presses with which low pressures are used. These presses require a slightly more complicated die design than those employing high pressures, but for many applications the saving in power may make them more economical.

Good pressings may be produced on small presses with as little as 150 tons capacity, but most normal hydraulic presses of this type use between 300 and 600 tons pressure, with a platen pressure of 0.7 tons per sq. in. The rubber pads used on these low-pressure presses are either solid or built up from 1-in. laminations of 50 to 55 Shore hardness. The internal pressure of this soft rubber is not always adequate to complete all forming operations, in which case it is reinforced by mechanical means.

An ironing plate made of ¼-in. boiler plate, cut away in the centre so that it just clears the finished shape of the component, is located on top of the blank material. When the pressure is applied the rubber comes into contact with the surface of the plate and is forced into the space cut out of it. The rubber thus compressed forces the material to the shape of the die. The ironing plate itself greatly helps in preventing the formation of wrinkles at the corners of the part.

Unless large parts of heavy gauge are required, these low-pressure types of press with moderately soft rubber will form all standard parts of normal size. Working on a single large ram, they have a very rapid cycle, particularly when designed to accommodate four loading tables.

Two types of presses, standardized during the war, are still in general use in this country, one a high-power type of cast-steel unit construction and the other a low-power type of mild-steel plate construction.

In the high-power type, units each of about 2,670 tons rating with a platen area of 3 ft. by 4 ft., are coupled together to form presses rated at 5,340, 8,000 and 10,700 tons respectively, with a maximum pressure of 1½ tons per sq. in., working dimensions being respectively 6 ft. by 4 ft., 9 ft. by 4 ft. and 12 ft. by 4 ft.

The low-power type is built in sizes ranging from presses of 500 tons capacity with platen dimensions of 3 ft. by 2 ft. to machines of 2,600 tons capacity with platen dimensions of 6 ft. by 4 ft., the pressure in all cases being 0.5 tons per sq. in.

In a typical high-power press the rubber pad is 9 ft. by 4 ft. by 10 in. and is housed in a steel container, being vulcanized to a steel plate in which are tapered holes to secure a firm anchorage. The plate is easily removable for the renewal of the rubber pad.

The platen, which is mounted on the crosshead of the cylinders, moves upwards into contact with the rubber by means of a series of hydraulic cylinders which distribute the pressure evenly over the whole area. Forming dies are grouped on the platen with not less than 2 in. between each die.

The press is provided with two loading tables carried on rollers mounted on ball bearings; either table, when loaded ready for operation, may be run on to the platen. The rollers on the platen are spring-loaded so that as soon as the rubber is engaged the load is transferred from the rollers to the platen. The tables are moved in and out of the platen by means of a frictional drive.

A control panel electrically controls the press; there is a single lever for the main operation of the press and two levers for operating the safety doors situated at each end of the platen. These doors are connected with the main control lever so that the press cannot be operated until both are closed.

This type of high-power press is capable of exerting a pressure of 1.5 tons per sq. in. which is sufficient to bend 10-s.w.g. heat-treated alloy sheet. Most components, however, can be formed at much lower pressures than this. Most normal requirements can be formed at a pressure of 0.7 tons per sq. in.

A typical low-power press in present use is made from contoured mild-steel plates each about 1½ in. thick. Power cylinders and driving units are considerably lighter than those in the high-power unit press and the whole may be erected much more quickly.

The loading system consists of four tables, two being loaded at each end, the platens running into position and then being power-fed on to the cross-head of the cylinder in turn. The rest time of the unit in proportion to the working time of the press is thereby reduced. Otherwise, the method of operation is the same as that with the high-power press.

Pressure is about 0.3 to 0.4 tons per sq. in. and the type of die used is therefore the same. The action can "dwell" at any point of the stroke if required, which greatly helps the production of complicated components. The cycle time for the 2,650-tons capacity low-power press is 5 minutes for a complete operation, each table being processed.

The rubber pad is housed in a steel container strong enough to withstand the total bursting pressure exerted by the platen, the thickness of the rubber being about two-thirds the depth of the container. The dies are grouped on the surface of the platen and the blanks placed upon them, located with pins. The dies and blanks are brought into contact with the rubber pad and pressure is applied. The steel container prevents lateral movement of the rubber, thus forcing it against the blanks and dies.

Due to its elasticity the rubber deforms as pressure increases forcing the metal blanks to assume the shape of the dies. On removing the pressure, the rubber goes back to its original form ready for the next operation.

If separate blanks are used for each component they are placed in position by locating pins on the dies. Provided that dies of approximately the same height are grouped together, the gauge of metal need not be the same for all the components. When a single sheet is being formed into blanks the dies should be grouped economically and the sheet placed over them. Pressure is applied to all blanks simultaneously so that they are formed with one stroke of the ram.

When blanks for large numbers of components are to be sheared the shearing dies should be grouped over the loading table so that they occupy the entire area of a sheet of stock size. The sheet is then placed over the dies and pressure is applied.

Dies for use with the rubber-die press are made to the inside of the metal shape to be formed. In many typical shapes the dies are designed to combine shearing and forming in one operation. Forming dies should be at least $\frac{1}{4}$ in. thicker than the depth of the flange to be formed and for most forming operations dies $\frac{3}{4}$ in. thick are suitable.

When designing tools for forming by the rubber press, it should be remembered that parts can be formed by external pressure that could not be formed satisfactorily by internal pressure; that is, forming should take place over a projection rather than into a recess.

Where, for example, a shape is to be bent through an angle of 90 deg., if external pressure is applied with a forming block, as shown in Fig. 2, relatively little pressure is required owing to the even distribution of the load and a close fit will be obtained at the apex (Fig. 2*a*) irrespective of how large or how small the radius may be at that point.

Conversely, a bend obtained as shown in Fig. 2*b* calls for considerable localized pressure during the latter part of the forming operation and, even so, it may not be possible to obtain a good, sharp corner at B without an additional operation.

For raising or forming flanges, stiffening ribs, lightening holes and bulkhead panels, temporary dies of seasoned hardwood or red fibre are suitable when only a few hundred components are needed. If faced with metal, the same dies can produce several thousand components.

Flanging dies are also often made of a proprietary material—Jabroc—composed of Canadian birch veneers impregnated with phenol-formaldehyde subjected to heat and pressure. Supplied in boards of from $\frac{1}{4}$ in. to 2 in. thick, this material has a specific gravity of 1.3 to 1.4, with a compressive strength of about 40,000 lb. per sq. in. and a Brinell hardness of 45. The working of this material is simple; it can be drilled and filed in the normal way and is easily routed.



Fig. 2.—(a) Forming a V-bend by external pressure; (b) Forming a V-bend by internal pressure.

Permanent forming tools can be cut from mild-steel plate at a fraction of the cost of hardened steel dies. Using a pantograph burning torch, mild-steel plate can be cut to within $\frac{1}{32}$ in. of the finished line, leaving little additional finishing.

Steel plates, similar in shape to the die but slightly smaller in size, are sometimes used for cover plates and serve to remove local denting in the material. The blank to be formed and the cover plate located on the former are positioned on locating pins.

Cast-iron dies are also suitable in the case of large tools especially where high pressures are involved. They can be substantially lightened by introducing recesses for that purpose during the casting process.

The majority of dies used in rubber presswork are made from zinc-base alloys, which are easy to work and possess very good surface qualities. The alloy normally used consists of a mixture of 96 per cent zinc with 4 per cent copper and requires a casting temperature of 450° C. with a contraction allowance of 1 in 120.

A material known as K-M alloy, which has proved most satisfactory, consists of about 4.1 per cent aluminium, 2.7 per cent copper and 0.04 per cent magnesium, the remainder being zinc of 99.99 per cent purity. Most dies for components with flanges up to $\frac{1}{2}$ in. in depth can be manufactured from sheet 1 in. thick. The material, which is relatively soft, can be worked on normal wood-working machines by pattern-makers.

Unless used consistently at high pressures, zinc does not spread under pressure; but it is advisable to strengthen large dies by the addition of a 10-s.w.g. mild-steel plate and open-ended dies should always be fitted in such a way as to overcome the tendency of the rubber to force the ends apart. Where the maximum pressure does not exceed 0.7 tons per sq. in. the life of zinc-base dies is almost indefinite.

Zinc-alloy dies may be either cast or made from sheet. When made from sheet, the first step is to scribe out and cut to shape a form template in mild steel of 10 s.w.g. The shape of this template is then scribed out on a section of zinc-alloy sheet and trimmed with a bandsaw to give a rough

die blank ; this is trimmed to finished size with a spindle moulder, the cutters being of such a shape that the radius of the top surface is machined at the same time.

Tooling holes are drilled from the template and bushes let into the zinc-alloy die at the correct positions. Accurate location of these holes is essential since the accuracy of the finished component depends on them.

To make the pressure-plate, which is placed on top of the jig to prevent buckling of the web of the component when under pressure, a duplicate of the template is made from mild-steel plate of 10-s.w.g., tooling holes are drilled into it and the edges chamfered to remove all rough surfaces.

When the die is made as a casting, a plaster or wooden pattern is built up to the finished size with an allowance of 0.25 in. for machining. It should embody any lightening recesses and plaster patterns should be reinforced with wire.

A mould box which will take the finished casting is placed over the pattern and the sand mixture rammed in by hand until a compact mass is obtained, the sand being reinforced at stages with small wires. The mould box is then inverted, the top portion of the box being placed on top of the mould and the sand rammed in to take the form of the top surface of the pattern.

When the boxes are opened and the patterns removed, the moulds are finished by hand to ensure that all edges are true. Flow channels are produced to allow the zinc to run through one section to another and small holes pierced in the top and bottom portions of the sand to allow the air to escape while pouring.

To remove any moisture and prevent any condensation the moulds are kept at about 100° C. with a blow-pipe flame. It is essential that the moulds should be perfectly dry when pouring takes place, otherwise castings are pitted with blowholes.

The two sections of the mould are bolted together and the zinc alloy poured in until the molten metal becomes visible in the risers, which are topped up in turn to allow for shrinkage of the material and to remove any dross from the casting. After the casting has been removed from the moulds the risers are sawn off on the band-saw. The top and bottom surfaces of the casting are levelled and the contour machined to shape with a spindle moulder.

Tooling holes are drilled from the master template and bushes let in at the correct positions, while a duplicate of the template made of 10-s.w.g. mild steel is fitted to act as a pressure plate.

When the component for which the dies are being made has small radii, bearer blocks, made from small castings, are fitted to the dies. When fitted, these bearer blocks are screwed on to a base plate of 10-s.w.g. mild steel fixed around the outside of the standard die in the correct positions.

Small locating pins of standard size, used to attach the blanks or ironing plate and blanks to the die, are fitted into the tooling holes. The pins have specially shaped heads so designed as not to damage the rubber of the pad. A point in favour of zinc-base dies is that obsolete dies can easily be melted down and recast without wastage of material.

Combination dies, which not only form the components but also form beads and blank the holes in one operation, can be made of the same zinc-base alloy.

The radius of dies on all bent edges should be as large as possible in order to avoid cracking of the material. The radius should be equal to three times the thickness of the sheet being processed—a point that is particularly important when aluminium-alloy sheet in the aged condition is being flanged. Shearing dies, which can be made of compressed composition material such as Jabroc faced with chromium-molybdenum steel plate to form the shearing edge, are backed off to an angle of 6 deg.

It is not necessary for dies assembled on the platen to be all of one thickness since the rubber pad will adapt itself to differences in depth. But when dies of different heights are assembled together on the platen, it is important that they should be as far apart from one another as is practicable in order to allow the deformed rubber to reach the surface of the platen in the spaces between the dies.

When the working pressure per sq. in. on the platen is not high enough to prevent springback of the metal after the pressure has been released, the die-face may be "backed-off" in order to compensate for the elastic recovery of the material ; 4 deg. of backing is usually enough.

The greater the power of the press, the smaller the tendency of the material to return to its original shape when released from it.

It should be noted that the high-strength alloys should always be worked in the softest condition possible ; but with some of the softer alloys and pure aluminium it may be preferable to use material in the quarter- or half-hard condition.

Rubber compresses extremely little—about 0.04 per cent per 100 lb. per sq. in.—but displaces very readily. It has a relatively high yield range or elongation, varying with the hardness, which is quoted in terms of Shore hardness, a term derived from the Shore Durometer, a testing gauge universally accepted in rubber technology as the most reliable method of differentiating between comparative degrees of hardness.

Hardness as determined by this instrument is quoted in degrees, the softest type of rubber, which has a gelatine-like texture, having a Shore

hardness of 15 to 20, while very hard rubbers have hardness figures as high as 95 to 100.

In the production of tooling rubbers a wide range of hardnesses and elongations is obtainable. Where hardness is concerned, the following considerations must be remembered when rubber is mounted for any particular job. A soft rubber displaces more readily under pressure than a hard one and reduces the working stresses in the early stages. At the same time the displacement may be too rapid for pressure to be exerted where required at the proper time and the flow of metal may, therefore, be impaired.

In some cases this rapidity of flow may force the rubber behind the deformed or flanged portions of the work before complete deformation has taken place. Conversely, too hard a rubber tends to " bank up " and displaces too slowly, so that even under maximum pressure complete closure is not achieved. When this is so, spaces are left owing to the lack of mobility of the rubber.

Rubber having an elongation range of 350 to 650 per cent is suitable for all operations performed on the rubber-die press. In terms of hardness, rubber with a Shore hardness of from 50 to 60 is recommended for drawing operations, hardnesses of from 65 to 80 being the best for forming and shearing respectively.

It is unnecessary to have a separate rubber pad fitted for each of these operations. One of a hardness of 70 to 75 can be used for general purposes, supplemented for shearing operations with a layer of harder rubber, approximately 1¾ in. thick, covering the entire surface of the pad. For drawing, separate pieces of a softer rubber may be applied locally.

The most important factors in the compounding of rubber tools are resistance to abrasion, uniform extension throughout the mass and immediate recovery to normal after deformation, resistance to ageing effects and adequate tensile strength—about 3,500 lb. per sq. in.

The life of the rubber will be considerably longer if the pad is entirely confined in the pressure container and not stretched beyond the elastic limit by excessive deformation when the working load is applied. It is important that the platen should fit well into the pressure container to prevent the rubber being extruded around the sides and thus damaged.

It is possible to produce 20,000 aluminium-alloy parts as a reasonable forming operation without appreciable wear to the rubber surface. Great care should be taken to ensure that damage to the surface does not exceed 2 in. in a 10 in. block, since damage beyond this depth makes repair difficult, if not impossible.

Impaired surfaces may be built up by grinding away the worn parts and adding a self- or cold-vulcanizing rubber compound. This is best done by removing the rubber block from the press and returning it to the manufacturer for repair. However, provision is made in the Fielding press (Fig. 1) for vulcanizing the uncured rubber additions without removal of the pad from the press.

The use of correct lubricants in rubber press-work, especially in drawing operations, is essential to avoid drag between the sheet metal and the die. Lubricants recommended are the non-abrasive powder type such as french chalk or fine graphite, which should be dusted on the metal being formed before the pressure is applied, should it be found that the material has a tendency to drag over the dies.

Oil or grease must never be used since both mineral and vegetable oils cause natural rubbers to become viscous and lose elasticity; but some plastic " rubbers " may not be so affected.

Technique

When conducting blanking or piercing operations on a power press, it is necessary only to calculate the energy required to overcome the resistance of the metal to be sheared, that is, the shear strength of the material multiplied by the area to be sheared. The entire available energy can then be concentrated at the points where it is required.

The case is different, however, when blanking is performed by the rubber-die press. In power-press technique shearing is due to the sudden impact of the applied force. With the rubber press the essential factor is pressure, and it is necessary to build this up until it exceeds the resistance offered by the metal.

Nor can the critical pressure be applied at a given point; it must be exerted over the whole area with which the rubber makes contact, so that, in blanking with the rubber press, what must be considered is the hydraulic pressure available to the surface area of the rubber pad and platen. For instance, if the hydraulic pressure is 1,500 tons and the platen area is 1,000 sq. in. then the useful force is 1.5 tons per sq. in., but if the platen area is increased to 2,000 sq. in. then the useful force is only 0.75 tons per sq. in.

To take an example from piercing it would be a simple matter on a power press to pierce a hole 1 in. long by ⅛ in. wide in Duralumin of 24 s.w.g. The area of the metal to be sheared in this instance is found to be 0.05 sq. in. Assuming the shear strength of the alloy to be 15 tons per sq. in., it will be necessary to apply a force of over 0.75 tons. There is, however, an area of only 0.125 sq. in. on which to operate, so that a pressure of 6 tons per sq. in. is necessary to bring about the desired collapse of the material.

While this would be simple enough on an ordinary power press it would be quite beyond the capacity

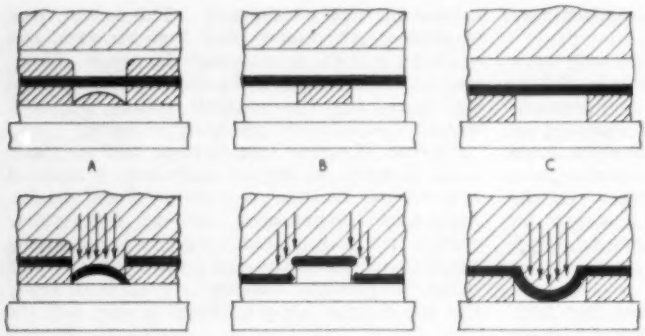


Fig. 3 (left).—(a) Set-up advised for blanking clean holes; (b) set-up requiring less pressure but results in rough edges; (c) set-up to be avoided as it results in torn edges

Fig. 4 (below).—Typical shearing tool for thin-gauge material. Dimension ¼-in. to ⅜-in. is suitable for sheets of 18 s.w.g. and less

of the rubber-die press. In fact, a rubber press capable of exerting a pressure of 2 tons per sq. in. would not pierce a clean hole of ⅜ in. diameter in 24-s.w.g. Duralumin, although it would produce a hole of somewhat smaller diameter having a rough edge, if the set-up shown in Fig. 3*b* were used.

The problem is one of effective pressure area, as shown in Fig. 3. With the tool design shown in Fig. 3*a* the effective area of unsupported metal on which pressure can be exerted is that of the hole itself. In the case of a hole ¼ in. diameter in 24-s.w.g. Duralumin the effective unsupported area is less than 0.2 sq. in., which would require a pressure of 2.6 tons per sq. in. to provide a clean shear.

Where a hole of rough edge is not objected to, a tool design as shown in Fig. 3*b* can be used, in which case the area of effective pressure (*see* arrows) would be about 0.6 sq. in. and a pressure of 0.86 tons per sq. in. would suffice.

In calculating pressures for piercing, all figures must be based on the area of unsupported metal. For practical purposes, when using the rubber press with an applied pressure of 2 tons per sq. in. it may be assumed that the effective area is that of a strip varying from ⅛ to ⅜ in. in width along the line of cut.

A set-up to be avoided is that shown in Fig. 3*c*, which, although it gives a greater effective working area, results in torn edges instead of a clean cut. This method should be used with only the heavier gauges of sheet where there is less tendency for the metal to bend or distort.

The question of pressure required for piercing small holes is important since it is the smallest hole in a component that determines the pressure necessary for the production of that component. The real value of the rubber-die press for piercing becomes apparent when a multiplicity of small holes in a part is to be produced. For instance, with a power press if a pressure of ⅜ tons per sq. in. is necessary to produce one small hole, then simultaneously to punch one hundred such holes a power press of 75-tons capacity would be needed.

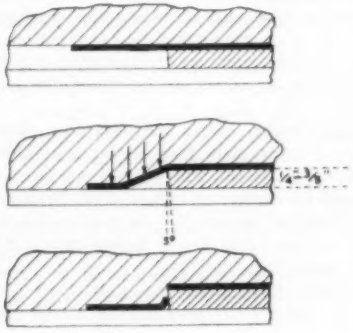
With the rubber-die press, by economical grouping of blanks and dies on a platen of, say, 24 sq. ft. several hundred holes could be pierced in one operation with no more power required than for the production of a single hole.

The rubber press is particularly suitable for the production of flanged holes where clean holes are essential if the development of cracks is to be avoided.

Blanking by rubber press is not economical for small sizes of 2 in. to 3 in., since each part requires a marginal allowance of at least 1 in. on 20-s.w.g. Duralumin, so that the ratio of scrap to blank size is very high. However, owing to lower tooling costs, the rubber press may be more economical than the power press where a large number of different shaped blanks can be cut simultaneously.

Except in the thinnest gauges, Duralumin blanks are very difficult to shear in the rubber press without burrs, which must be removed by hand if the blanks are to be used in subsequent pressing operations. Shearing by rubber press is more satisfactory and gives cleaner edges on sheet of pure aluminium or the softer alloys such as NS3 (B.S.S. 1470).

A typical shearing tool for material of 18-s.w.g. or less is shown in Fig. 4. The base of the tool is made of Canadian birch laminations, bonded



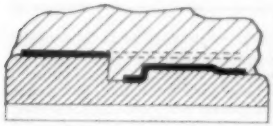


Fig. 5 (left).—Combined blanking and forming tools

by heat and pressure and $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick, faced with stainless steel of 20-s.w.g. The edge of the tool is backed off at an angle of 5 deg. The blank should overlap the edge of the tool by at least 2 in. If a sheet of rubber $\frac{1}{4}$ in. thick and of the same hardness as that used in the platen is placed over the part to be sheared, it will concentrate the load and save wear on the main pad.

In practice, much of the production of blanks for rubber presswork is better done by the high-speed router.

Blanking and forming of large components may often be carried out in one operation. The simple tool lay-out shown in Fig. 5 for this combined work illustrates the saving in tool costs compared with the expensive tool outlay that would be necessary if the work were done on a power press. Shapes such as ribs with numerous lightening holes can be produced with two simple tools : a blanking template of 10 or 12 s.w.g. made of mild steel to the developed shape of the component, and a zinc-alloy casting for the second stage of blanking and flanging.

A simple flanging operation is shown in Fig. 6. A springback angle as shown is necessary, 3 deg. being an average value for alclad to HC14 or HC15, although the angle will vary slightly according to the pressure applied and the shape of the flanges.

To ensure correct forming a gap must be left between the platen and the bottom of the formed flange ; if this is omitted the flange will be slightly convex. The minimum allowance is $\frac{3}{8}$ in. as indicated. Since the maximum height of tool is limited to 4 in.—about one-third the depth of the rubber pad—flanges cannot be formed deeper than $3\frac{1}{4}$ in.

Flanged holes may be regarded as normal flanges. Ordinary fluting cannot be formed to a greater depth than $\frac{1}{2}$ in. or shearing will occur. Since fluting stresses the material and generally reduces the gauge it should not be considered as the press substitute for drawn sections. It is better practice to raise sections of the material to a height of from $\frac{1}{4}$ in. to $\frac{3}{8}$ in.

A method of forming lipped and reversed flanges is shown in Fig. 7. Since such parts are frequently long in proportion to their breadth, one of the flanges often has a large convex radius which causes the part to buckle and sometimes twist along its main axis. While this is not serious, the possibility should be borne in mind. Fig. 8 illustrates the

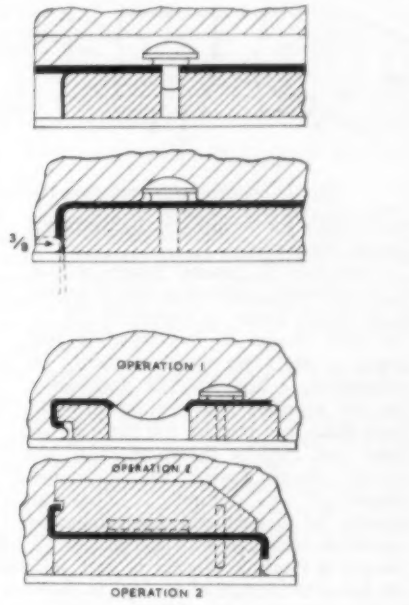
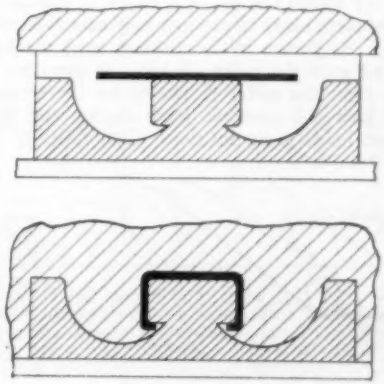


Fig. 6 (top).—Method of forming simple flanges shown before and after forming

Fig. 7 (centre).—Method of forming lipped and reversed flanges

Fig. 8 (below).—Tool design for forming double flanges



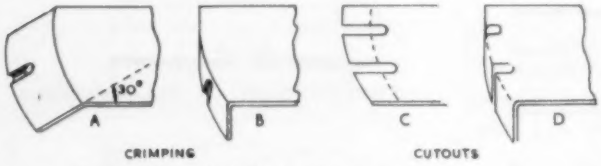


Fig. 9.—Methods of forming flanges around convex radii

tool design for forming straightforward double flanges.

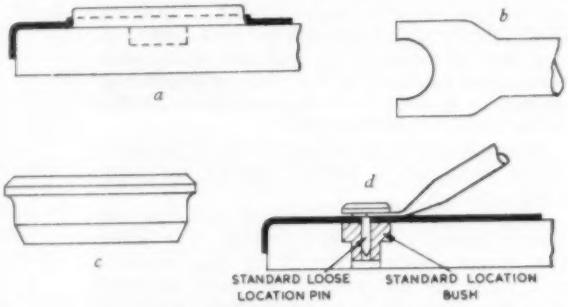
A method of forming flanges around a convex radius, providing what is known as a shrink flange, is shown in Fig. 9. To form flanges of this type the free edges of the sheet must in theory be compressed. For practical purposes it can be assumed that no compression takes place, but buckles will form in the sheet and may be incorporated in the design process known as "controlled wrinkling" or "crimping." They can usually be located and formed in one operation, although with material of 15-s.w.g. and thicker a locating process is first necessary with the flange at an angle of 30 deg., as shown in Fig. 9*a* and 9*b*. Another method is to provide "cut-outs" to relieve the compression. A section of the blank with "cut-outs" is shown in Fig. 9*c*. The part after forming is shown in Fig. 9*d*.

Standard tools are shown in Fig. 10. The blanks are positioned on formers with loose location pins usually $\frac{3}{16}$ in. or $\frac{1}{4}$ in. diameter; the pins have recessed heads so that they may be withdrawn with a forked lever. Soft forming tools are normally fitted with steel location bushes since constant withdrawal of the pins causes excessive wear on the composition tool.

It is good practice always to position location holes in such a way that, when reversing the blank, the holes do not mate with the bushes in the tools. For this three holes are necessary.

Fig. 11 shows the use of a roller in conjunction with the form blank to produce very narrow, straight flanges. As shown in the diagram at A the blank is placed with the roller on top. A pressure pad higher than the roller is placed on the blank to ensure that the pressure load reaches the blank first and holds it in position. The roller is then

Fig. 10 (below).—Standard tools for locating blanks, etc. (a) Standard button for forming flanged holes the reverse way to edge flange; (b) Type of lever used for removing location pins; (c) Standard plungers used for concentrating load for forming flanged holes. Only used on small holes and thicker gauges, e.g., $\frac{1}{8}$-in. dia. on 18 s.w.g. D.T.D. 390



pressed downwards into the recess provided and thus forms the flange as it descends.

Narrow flanges having large radii require greater pressure concentrations than do flanges with wide flutes and small radii.

Closely allied to the forming of convex flanges is the forming of joggles, which consist of offsets in the bend line of a part as shown in Fig. 11B, and involve reducing the width of the web locally without changing any other dimensions. Although normally formed with mechanical dies, there are various ways of producing them on the rubber press. One method both of forming joggles and very narrow, straight flanges is to use a specially shaped roller, as shown in Fig. 11C, in the same manner as above.

When a joggle or other indentation is necessary in a component being formed in the fully heat-treated condition, it is often desirable to place an ironing plate on top of the blank with the desired shape cut into it, thus concentrating the pressure at the point required.

The use of undercut die blocks with an appropriate bearer block, as shown in Fig. 12, gives good results when short flanges are required on fully heat-treated material or on annealed sheet

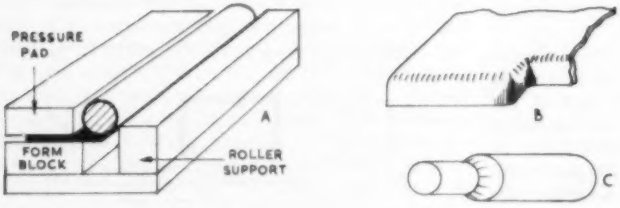


Fig. 11.—Using a roller to form straight flanges and joggles

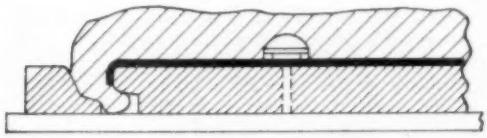


Fig. 12.—The use of undercut dies to form narrow flanges having large radii ; a bearer block is required to concentrate the pressure

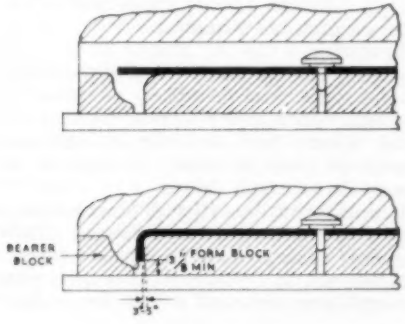
of heavy gauge. The depth of an undercut should not exceed $\frac{1}{16}$ in., otherwise the pressure concentration upon the radius will cause the horizontal top flute to curve upwards.

Forming involves compressive strains and consequent wrinkling in many parts, but the development of the bearer block technique has increased the range of permissible strains considerably. This consists of an auxiliary block placed adjacent to the regular form block in the region where the shrink flange is to be formed, as is shown in Fig. 13.

The inner surface of the bearer angle may be straight, as shown, or curved upwards, as in Fig. 14, the effectiveness of each being approximately equal. Table I gives recommendations for the construction of such blocks. It is not claimed that wrinkles can be eliminated by the minimum contour radii recommended, but they will prevent the occurrence of very tight wrinkles which cannot be removed by hand.

The use of metal wedges made from an alloy such as "Cerrobend" will often eliminate the need for hand work. To make the wedges, a blank is formed over the form block and finished by hand, and the Cerrobend is poured into the space between the part and the bearer block. After the metal has solidified it should be removed and cut into a series of separate slugs to provide for self-adjustment. The blank is then placed upon the form block and pressure applied; the Cerrobend wedges are now placed in position and pressure again

Fig. 14.—Bearer block designed with curved inner edge, showing springback allowance on the form block



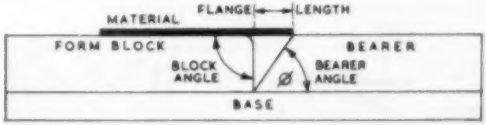


Fig. 13.—Bearer block technique for the control of wrinkles

applied. This may be repeated several times until a perfect part has been produced.

By using a convex bearer block it is possible to overcome difficulties in convex flanging by drawing a deeper flange than is required, the excess of flange absorbing the wrinkles and being subsequently trimmed off.

Another method of forming flanges is shown in Fig. 15. A blank locating block, which rests on springs, enables the blanks to be correctly located. A draw ring is placed on the top of the blank locating block and the part formed, the springs being compressed as the draw ring and locating ring are forced down. When the load on the rubber pad is released the locating block acts as an ejector and forces the part off the tool.

TABLE I—*Recommendations for Bearer Block Angles*

Material thickness	Flange length (in.)	Minimum flange contour radius for bearer (in.)	Bearer angle (degrees) 120	90	80
24 s.w.g. 0.022 in.	$\frac{1}{2}$	3	65	55	45
	$\frac{3}{4}$	3	"	"	"
	1	4	"	"	"
	$1\frac{1}{2}$	5	"	"	"
22 s.w.g. 0.028 in.	$\frac{1}{2}$	3	65	55	45
	$\frac{3}{4}$	3	"	"	"
	1	2	"	"	"
	$1\frac{1}{2}$	4	"	"	"
20 s.w.g. 0.036 in.	$\frac{1}{2}$	3	67	57	47
	$\frac{3}{4}$	3	"	"	"
	1	2	"	"	"
	$1\frac{1}{2}$	3	"	"	"
	2	3	"	"	"
18 s.w.g. 0.048 in.	$\frac{1}{2}$	4	70	60	50
	$\frac{3}{4}$	3	69	59	49
	1	3	"	"	"
	$1\frac{1}{2}$	3	68	58	48
	2	4	"	"	"
16 s.w.g. 0.064 in.	$1\frac{1}{2}$	4	70	60	55

Note.—In all joggled or recessed areas 5 deg. must be added to the bearer angle recommended for the immediate section on the bearer where these occur. If the lower edge of the bearer angle interferes with joggle forming, this edge may be cut out or trimmed suitably.

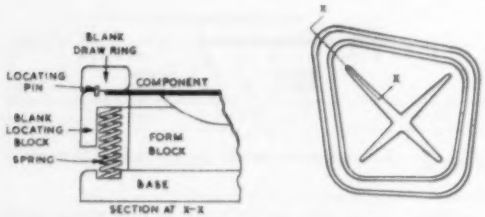


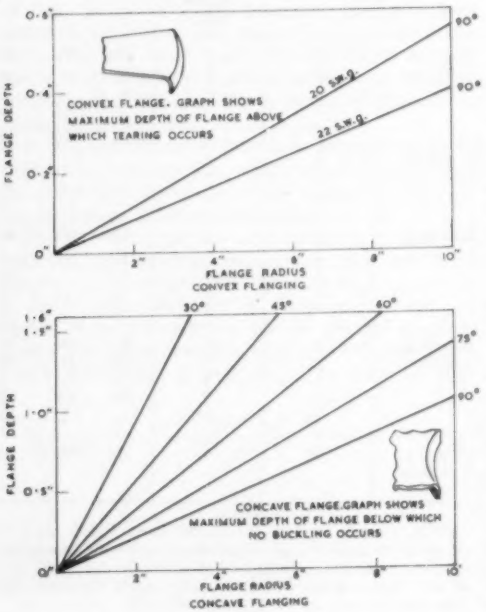
Fig. 15.—A flanging method using a spring block and a draw ring

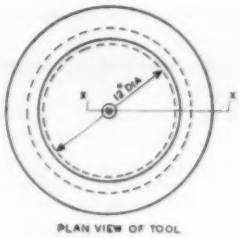
Fig. 16 shows the formation of flanges around concave and convex radii where wrinkles are not allowed. The two graphs show the respective flanges which may be formed without wrinkling or splitting in the free condition for any given radius.

Fig. 17 shows the method of forming and flanging circular blanks of comparatively small diameter, for example, 12 in., in which a circular steel frame located on the edge of the blank is used. Careful positioning of the former is necessary if it is not to be forced down unevenly and bent.

A forming die incorporating a top plate with hinged side members may also be used to ensure a more positive pressure than would be possible

Fig. 16.—Graphs showing permissible depths for convex and concave flanges. Angles shown are 180 deg. minus the part angle





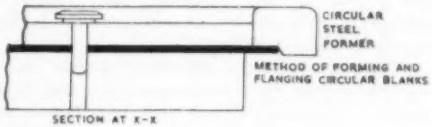
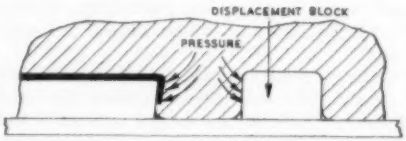


Fig. 17 (above).—Forming and flanging small circular blanks by means of a metal ring

Fig. 18 (below).—Method of increasing pressure on the form block by using auxiliary displacement blocks



when using the rubber pad alone. The hinged upper die is built up around the normal form so that, as pressure is applied, the side hinges close over the lower form die. By this means, sharp corners and very small flanges can be formed without wastage of material. Thus the need of an excess of metal to provide adequate leverage, which later must be trimmed off, is obviated.

Drawing operations can be carried out in Duralumin provided that the shape to be drawn is such that the restricted technique permissible by the rubber-die press can be applied.

The method is that the drawing die is placed on the platen and the blank interposed between it and the rubber pad. A piece of rubber sheet about 1 in. thick is used as a pressure pad to control the flow of metal during deformation ; large enough to cover the blank, it should be cut away to the shape of the part to be drawn.

Pieces of rubber from 60 to 70 Shore hardness are placed over the blank to be deformed. Pressure is applied, causing the loose rubber to force the metal into the die. When the pressure is released additional loose pieces of rubber are inserted so

that the draw is further extended during the second stage. The sheet is then annealed and the process repeated.

During the second stage of pressing the sheet is drawn about one-third the amount extended in the first stage; and each successive draw becomes less until the sheet touches the bottom of the die. Provided that the alloy is well annealed, a 7¾-in. draw can be completed in five stages: 4 in. in the first stage, 1½ in. in the second, 1 in. in the third, ¾ in. in the fourth and ½ in. in the fifth.

Female dies should be provided with air vent holes, otherwise considerable pressures may be built up between the material and the die, thus preventing the pressing from reaching the bottom of the die.

In the case of heat-treatable material the component should be solution heat-treated before the final draw.

The pressure to be exerted depends on the thickness and nature of the material; 18-s.w.g. Alclad sheet can be drawn with pressures of 500 lb. per sq. in.

If the draw is relatively deep it may be necessary to apply additional clamping pressure to stabilize the flange.

A trial run should be made to determine the size of the blank and the width of the flange. The extent of each draw should also be determined by trial. If this is done, a number of components can then be processed and carried to successive stages together, the depth of each draw being indicated on a gauge.

Die blocks for drawing are made from seasoned hardwood 1½ in. thick, glued and screwed together to form the required total thickness.

A difficulty experienced in the forming of aluminium alloys, especially Duralumin, by the rubber-die press is the springback of the metal; that is, the component when withdrawn from the press does not retain its true contour but springs back several degrees from the designed location.

Table II gives average form-block angles designed to counteract springback in parts formed in HC14 alclad in the naturally aged condition. The amount of springback is very small—often negligible—in the case of pure aluminium and the low-strength alloys.

The press load was calculated to produce an average pressure on the sheet of about 1,300 lb. per sq. in. Most of the parts were formed with rubber of Shore hardness of 60 to 65. It was found that the results were influenced by a number of variables, such as the magnitude of the unit pressure exerted on the part by the rubber die, the proximity of adjacent objects or form blocks, while rubber hardness and length of form blocks also had considerable influence on forming conditions.

It was noted that, if the pressure on the block exceeded a certain critical value, the angle did not change with further increase in pressure. From this it will be seen that springback angle may be stabilized considerably by exercising the maximum pressure practicable for the equipment used.

Unit pressure exerted on the form block may be increased materially by increasing the applied press load, the judicious use of "displacement blocks" consisting of metal blocks with a base 5 in. by 12 in. by 3½ in. with well-rounded corners as shown in Fig. 18, and by increasing the height of the form block. But care must be exercised when locating the number of displacement blocks on any one table loading. If an excessive number is used, the principal load will be taken by the displacement blocks, so that the form block itself will be subjected to decreased rather than increased pressure.

High-strength alloy sheet that is to be formed by the rubber press is normally used in the soft condition. The heat-treatable alloys—such as sheet to HS14, HS15, HC14 and HC15—are solution heat-treated in the normal way before

(*Continued in page* 586)

TABLE II—*Springback Angles for 90-deg. Bends in Sheet to HC14*

Radius (in.)	Material thickness					
	0.020 in.	0.025 in.	0.032 in.	0.042 in.	0.048 in.	0.064 in.
1/32	7½	7	—	—	—	—
1/16	9½	8½	7¾	—	—	—
3/32	11½	10	9	8½	7½	—
1/8	13½	11½	10	9½	8½	—
5/32	16	13½	11½	10½	9	8½
3/16	18¼	15½	12¾	11	9¾	9
7/32	21	17½	14½	12½	10½	9½
1/4	23½	19½	16	13½	11½	10
9/32	26	21½	17½	14¾	12½	10½
5/16	28½	23½	19	16	13	11½
11/32	30¾	25½	20½	17	14	12
3/8	33	27¾	22	18½	15	12¾
13/32	—	—	23¾	19½	16	13½
7/16	—	—	—	21	16¾	14½
15/32	—	—	—	—	—	15
1/2	—	—	—	—	—	16

For part angles other than 90 deg. multiply springback angle by the following factors:—

Part angle (deg.)	Factor	Part angle (deg.)	Factor
50	0.555	75	0.835
55	0.611	80	0.890
60	0.667	85	0.945
65	0.722	95	1.056
70	0.779	100	1.110

Form block angle + Springback angle = Part angle.

Automatic Control of Wiedemann Turret Press

(*Continued from page* 574)

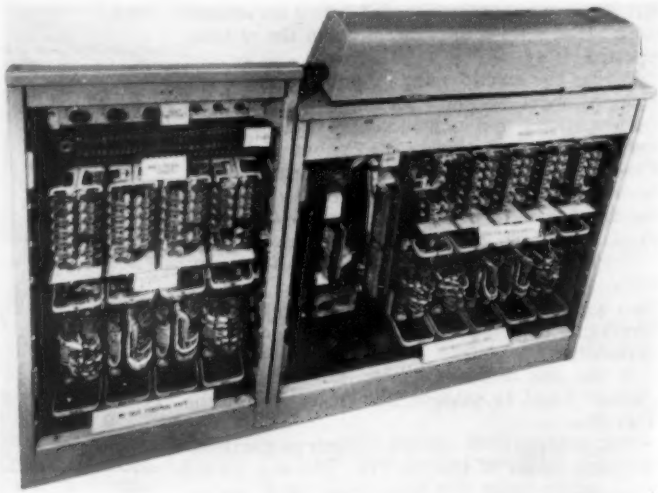


Fig. 6.—Rear view of control desk showing arrangement of relays

a second time so that only the minimum amount of tape is employed.

The panels produced on the press are punched with a standard series of apertures, but the position of these apertures may vary from panel to panel. Time can be saved by programming the punches required to make each aperture, taking the aperture's centre point as the datum, and then adding these individual programmes or sub-routines into a master programme. When sub-routines are added to the master programme in this way they are preceded by subsidiary X and Y co-ordinates which are accepted by the control, and the X or Y co-ordinates which follow are added or subtracted to give the true position. When the aperture has been punched, zero subsidiary co-ordinates are inserted so that any subsequent reading is as programmed. This method can also be used to make small identical components from a single large sheet of metal.

The control system is not able to carry out all the duties formerly performed by the operator, such as removing scrap and moving the clamps along the table. The programme must, therefore, contain coded information to warn the operator that these tasks must be carried out. When this occurs the press is stopped automatically and the appropriate indication is given on the control panel.

Advantages

Under automatic control higher output has been achieved by reducing operational time and by minimizing physical fatigue and time lost when an operator is away from his machine. This has resulted in a direct operational saving of 25 per cent in machine time, and a corresponding overall saving of 33⅓ per cent as the operator is able to perform other work while the machine is in operation. The use of sub-routines by the programmer responsible for compiling the instructions has resulted in a saving in time of 70 per cent and has greatly reduced the mental fatigue encountered in performing this operation.

A further important advantage resulting from the introduction of automatic control is a reduction in labour turnover. Under manual conditions operators are known to suffer from severe headaches due to the degree of concentration required and to the level of background noise. In consequence, requests for transfers to other machines are common and output varies considerably with different operators. With automatic control full output can be achieved, without physical strain, by an unskilled operator after a training period of two or three days.

Rubber-Die Press Forming

(*Continued from page* 573)

being pressed. Age-hardening, however, sets in within an hour of quenching and reduces the ductility of the material, thus making forming difficult if not impossible.

Therefore, when sheets cannot be used immediately after solution heat-treatment they are chilled in paraffin and placed in a refrigerated store, the temperature of which is from –8° C. to –10° C. At this temperature material can be stored in the solution heat-treated condition for about 48 hours and have a safe working period of about 2 hours on release. On removal from the cold store the sheets are held close to the loading tables in refrigerated trucks at a temperature of –8° C.

Before forming, heat-treated material should be flattened in a machine of the roller-leveller type since the press will not correct distortion caused by heat-treatment.

Fundamental Aspects of DEEP DRAWING AND PRESSING

By T. Ll. RICHARDS, B.Sc., Ph.D., F.I.M., F.Inst.P*

(This is one of a series of lectures presented at the Wolverhampton and Staffordshire College of Technology)†

Introduction

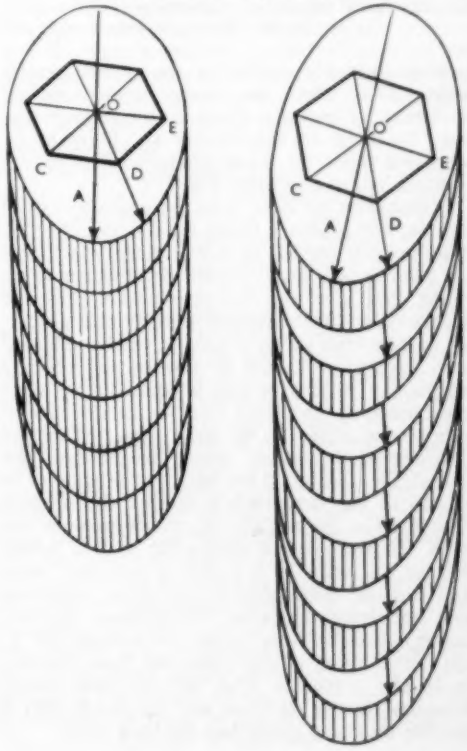
BEFORE discussing actual deformation of metals during deep drawing and pressing it is worthwhile considering why metals are ductile. It is only necessary to look at the Periodic Table to find the answer. In this Table where the elements are classified in the order of their atomic numbers and elements in the same groups have similar properties, the metals are to be found in the groups immediately after that of the inert gases. Metal atoms, therefore, have in general one, two or three electrons outside completely filled shells. These electrons are consequently rather loosely bound to the atom and, in a solid crystal, are freely shared with neighbouring atoms. A metal may then be regarded as a regular assembly of large positive ions in a cloud of relatively free electrons. Such a model accounts for the simple crystal structure of most metals, *e.g.* the hexagonal close-packed structure of zinc, and the face-centred form of close-packing of copper. Other simple metallic structures are, body-centred cubic and tetragonal, *e.g.* alpha-iron and beta-tin respectively.

Atoms in a metal crystal are held together in regular array by long-range attractive forces between the positively charged metal ions and the negatively charged electrons in balance with short range repulsion forces between like charges. Metals are therefore ductile since they can be plastically deformed by relative movement of the positive ions which would involve little disturbance of the cohesive forces, and certainly not irrepairable rupture of ionic bonds of the type which occurs in rock-salt crystals.

Crystal Slip

Study of the deformation of metal single crystals has revealed that deformation occurs by shear or slip on well-defined crystal planes and in particular directions. The latter are invariably along closely packed rows of atoms and the shear plane is generally but not always the plane of densest atomic packing. In hexagonal metals, zinc for example, only one family of such planes exist so that the deformation of zinc is very much like the shearing of a deck of playing cards (Fig. 1). Since deformation takes place by shear on definite planes then an applied stress can cause plastic strain only when it has a shear component acting along the plane. Thus zinc crystals will fracture brittlely if the basal plane of the hexagonal lattice, *i.e.* the plane of densest

Fig. 1.—*Diagram illustrating extension of single-crystal wire of metal of hexagonal structure*



* College of Advanced Technology, Birmingham.
† Eight lectures were given under the general title of "The Technology of Deep Drawing and Pressing".

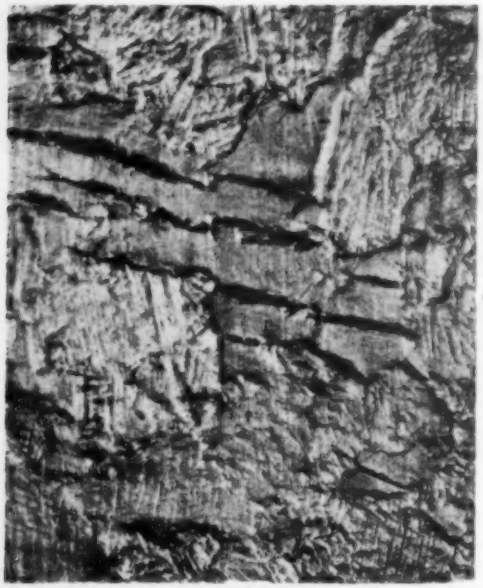


Fig. 2.—Photomicrograph of deformed coarse-grained zinc sheet illustrating fracture of grains unfavourably oriented for slip [*Courtesy of the Institute of Metals*

packing, is nearly normal to the applied tensile stress. This effect can cause trouble during fabrication of products from coarse grained zinc sheet for some of the crystals are likely to be orientated with the basal plane normal to the principal axis of extension (Fig. 2).

Deformation by shear is accompanied by lattice rotation, the tendency being for the slip plane to rotate towards the axis of extension and away from the compression axis. Severe deformation as in rolling can give rise to pronounced preferred orientation and consequently to directional properties in sheet strip which in turn, as will be indicated later, leads to difficulties in drawing and pressing operations. Rolling of strip is equivalent in effect to extension in the rolling direction combined with compression normal to the strip plane. When the close-packed hexagonal metal magnesium, for example, is cold rolled the basal plane tends to lie parallel to the strip surface so that the resolved shear stress on the available slip planes becomes very small and the material impossible to roll further without fracture. It is therefore necessary when cold working magnesium to use small reductions with interstage annealing. Magnesium however can be hot worked very readily above about 220° C. since other types of slip planes are then available. It is also fortunate that for the close-packed hexagonal metals titanium and zirconium, slip is possible on planes other than the basal plane.

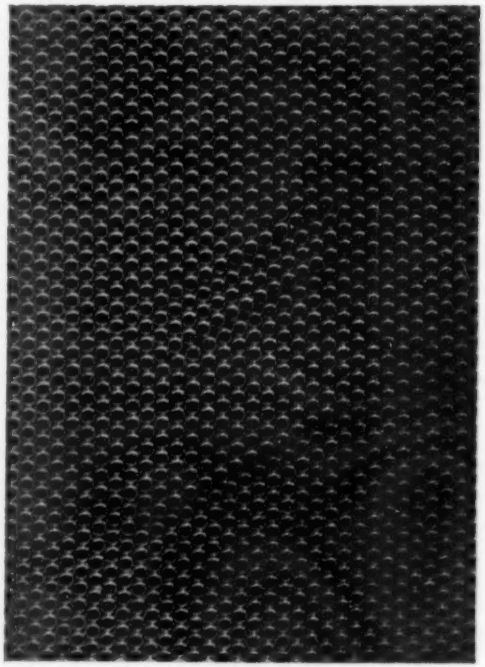
The face-centred cubic lattice has four families of equivalent planes of densest atomic packing with three directions of slip in each making 12 systems available. Slip naturally occurs on the system of maximum resolved shear stress, and regardless of the direction of the applied stress an appreciable resolved shear component will operate on one of the shear systems at least. This availability of shear systems accounts for the fact that face-centred cubic metals, *e.g.* copper, and also single-phase alloys of the same structure, *e.g.* 70/30 brass, are usually very ductile.

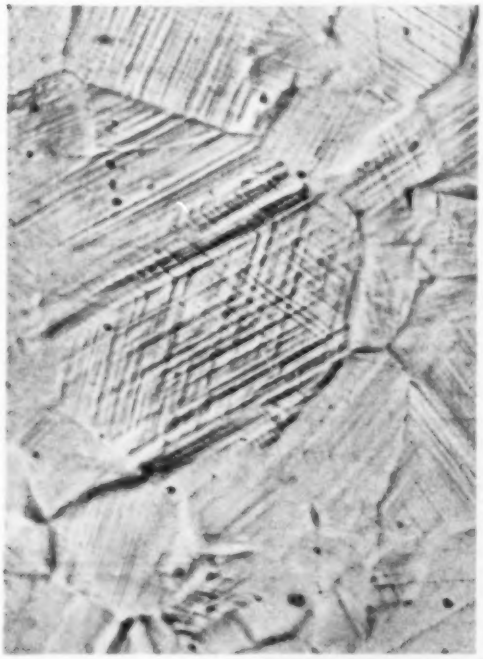
Slip can occur in body-centred cubic metals and alloys on three types of planes so that such metals would be expected to be extremely plastic and ductile. Nevertheless, the body-centred cubic structure not being fully close-packed is critically unstable and also one of the slip systems is identical with that of twinning. This may lead, in certain circumstances, to loss of ductility and to other undesirable effects during metal forming, to which some reference will be made later.

Dislocations

Shear on a slip plane does not take place over the whole plane at the same instant, indeed, if it did so it would require a force several hundred times

Fig. 3.—Sir Lawrence Bragg's bubble model
[*Courtesy of the Institute of Metals*





[*Courtesy of the Institute of Metals*

Fig. 4.—Multiple slip in face-centred material

greater than that actually observed. For this reason Sir Geoffrey Taylor and others considered that the deformation of metal crystals occurred by the propagation of a lattice imperfection or dislocation along the slip plane. The concept of a dislocation, which has been developed to the full stature of a theory accounting for much of the behaviour of metals, is beautifully illustrated by Sir Lawrence Bragg's bubble model (Fig. 3). It is also exciting to realize that a purely theoretical concept of 26 years ago has quite recently been confirmed by direct observation at the Cavendish Laboratory by Dr. Hirsch and his colleagues and a film showing actual movement of dislocations in aluminium and in stainless steel has been made.

Deformation of Normal Polycrystalline Material

Homogeneous Deformation

So far, attention has been directed towards the deformation of individual crystals, but in deep drawing and pressing concern is with the behaviour of strip composed of randomly orientated crystals. Since all metal crystals are anisotropic in their plastic properties then it is essential to know how to process strip free from preferred orientation and its consequent anisotropy in order to avoid trouble in the manufacture of mass produced articles. Anisotropy can give rise to waviness of the brims of cylindrical cups formed from strips and, if appreciable, will necessitate individual trimming thus adding significantly to the cost of the finished article.

The deformation of a polycrystalline aggregate must be practically homogeneous so that each crystal is deformed more or less in direct proportion to the section in which it lies, for otherwise an appreciable difference of strain in adjacent grains would be bound to lead to rupture at the grain boundary. In magnesium or magnesium alloys having only one family of slip planes in each crystal a difference in orientation between adjacent crystals will lead to a difference in the degree of deformation of each and this effect is undoubtedly a major factor in the failure of magnesium alloy uranium fuel cans.

In face-centred cubic metals and alloys, on the other hand, the problem is less acute since 12 families of slip systems are available and the strain in each crystal of the aggregate can be equalized by each crystal deforming on the most favourable set of five independent slip systems depending on its own particular orientation (Fig. 4).

Metallographic examination of 70/30 brass strip rolled with progressively increasing reductions, for example, shows that each crystal deforms more or less in direct proportion to the reduction of the strip, and that with reductions in thickness up to 40 per cent the deformation occurs on more than one slip system in each crystal (Fig. 5).

Work Hardening

It has been indicated that the low yield strength of metals is due to the easy propagation of dislocations along slip planes. When a dislocation passes through a region of the crystal it leaves the lattice just as regular as before and there is no increase in stress required to cause further deformation, *i.e.* no work-hardening occurs. In polycrystalline material, however, deformation occurs on several independent slip systems and there is considerable interaction and locking of the dislocations associated with each system and therefore appreciable work hardening. This interaction accounts for the much greater work-hardening of polycrystalline material compared with the single crystal of the base metal and for the rapid initial rate of hardening of the former. A stage is reached at about 40 per cent reduction by rolling when the metal becomes, as it were, saturated with dislocations, which cancel one another almost as rapidly as they are produced. On further deformation beyond this stage shear occurs on the principal shear planes associated with the imposed strain regardless of crystal orientation. In rolling, these planes make traces in the strip surface at right-angles to the rolling direction and are inclined at about 35 deg. to the strip surface. The shear that sets in after the crystallographic

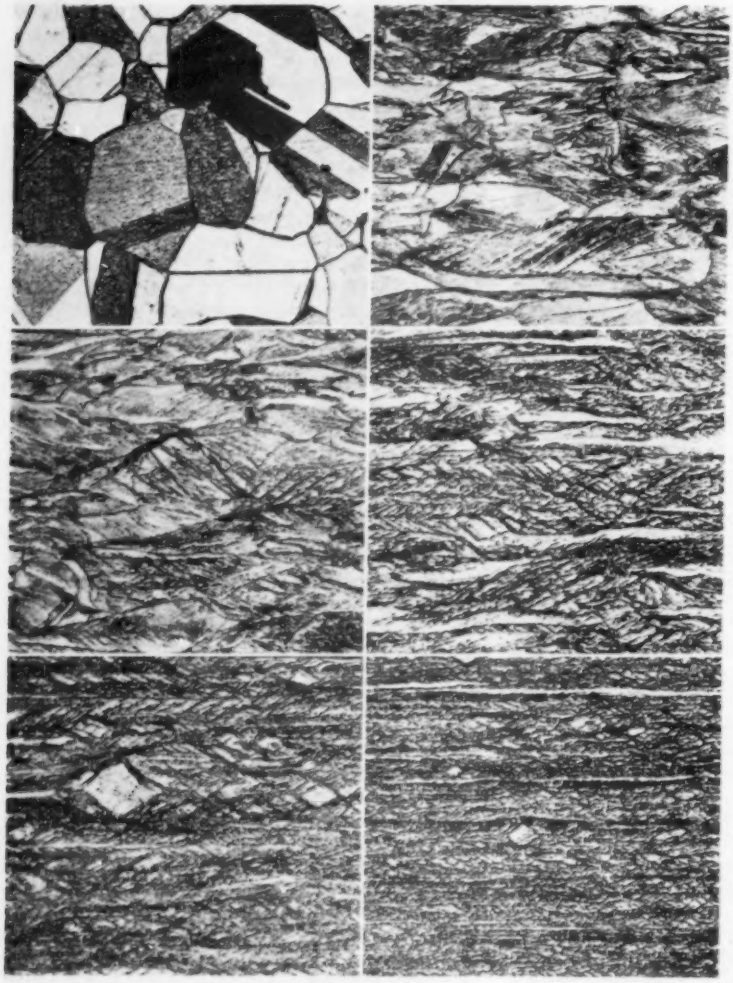


Fig. 5.—Microstructure of cold-rolled 70/30 brass (a) Initial structure; (b) 40 per cent reduction; (c) 50 per cent reduction; (d) 70 per cent reduction; (e) 80 per cent reduction; (f) 90 per cent reduction. Longitudinal sections. ×150

[Courtesy of the Institute of Metals]

slip is exhausted, being in the nature of a brittle type of shear, is associated with a much less rapid rate of work-hardening and can lead to a significantly lower strength of the material in the rolling direction than in the transverse direction (Fig. 6). With some alloys it can even result in complete fragmentation of the strip, and in such cases the metal must obviously be annealed before fracture sets in. The onset of the brittle type of shear usually sets the limit of uniform elongation in simple tension so that in deep drawing pure extension must be kept within that limit either by design of the operation or by interstage annealing.

The capacity of a metal to work-harden is the basic property which makes it suitable for deep drawing and pressing. This is because when deformation occurs in a small local region, that region stiffens and yielding takes place somewhere else. In this way the strain tends to equalise throughout the product. Certain metals, for example mild steel, exhibit a characteristic yield point at small strains and local softening occurs at the point of yielding. The strain then continues at the same point and leads to the well known stretcher strain effect. The trouble can be overcome with mild steel by effecting a uniform small strain beyond the yield point by roller levelling a short time before pressing. The difference in

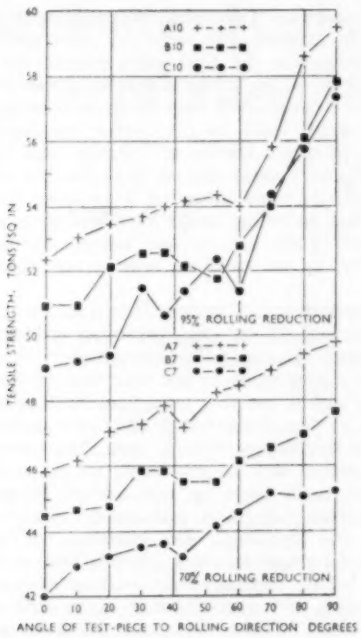


Fig. 6 (above).—The variation with direction of testing of the tensile strength of cold-rolled 70/30 brass strip

[Courtesy of the Institute of Metals

behaviour between a metal such as copper which does not have a sharp yield point and mild steel can be illustrated in a striking manner by bending short strips. Copper produces a smooth round bend while steel kinks in sharp bends (Fig. 7).

Preferred Orientation

Most metals can be cold-worked to a very great extent, by drawing down to wire or rolling to strip for example. In the process, each crystal is, as already indicated, deformed in proportion to the reduction of the material as a whole. In addition, the shear processes result in lattice rotation and to the development of preferred orientation, or texture, which becomes more and more perfect with increasing reductions. On final annealing, recrystallization occurs to produce new crystals with either a random orientation, or with an orientation resembling that of the rolled strip or with quite a different orientation, depending on various factors, particularly penultimate annealing temperature and grain-size, final rolling reduction and final annealing temperature. All metals are plastically anisotropic so that any appreciable amount of preferred orientation of crystals in strip and sheet is bound to lead to difficulties in deep drawing and pressing. It is therefore highly



Fig. 7 (right).—The different bending behaviour of copper and mild-steel strip

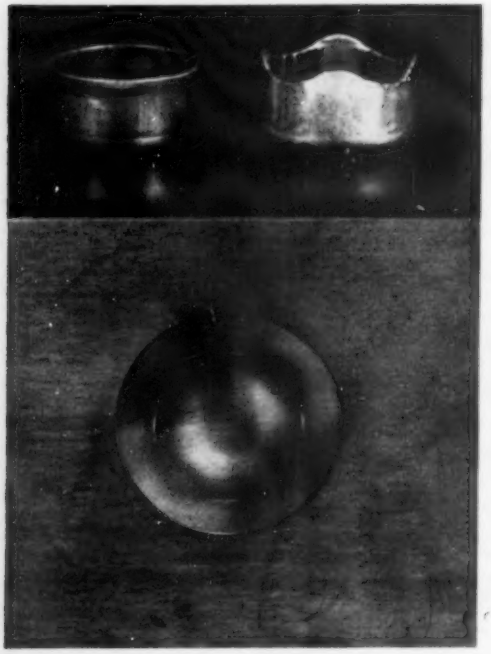


Fig. 8.—*Effects of preferred orientation or drawing behaviour of copper strip*

desirable to produce strip, if possible, with a completely random structure.

The preceding broad generalization may be illustrated by the behaviour of H.C. copper during cold rolling and annealing, although it should be appreciated that the precise behaviour of each metal or alloy will be different. If three slabs of H.C. copper are produced with three different grain sizes, say 0.02 mm., 0.04 mm., and 0.06 mm., by cold rolling and annealing at three different temperatures, in increasing order respectively, then in addition, the amount of secondary elements in solution, particularly oxygen, increases in the same order. Both the increase in grain-size and in solute content effects the rate and, after heavy reduction, the character of the final recrystallization behaviour.

On annealing after reduction in thickness ranging up to 50 per cent, recrystallization will be to a completely random orientation since deformation will have occurred on several differently orientated slip systems each being associated with potential recrystallization nuclei in different orientations. The finally annealed strip will therefore be quite non-directional and will, for example, yield cylindrical cups from circular blanks having perfectly level brims (Fig. 8).

The number of potential recrystallization nuclei naturally increases with degree of deformation and in consequence the final grain size of the strip diminishes. This is an important point to bear in mind in producing strip for deep drawing since coarse grain leads to the surface roughness on drawn products known as "orange peel" effect. Also the very small degree of strain that may be involved in some areas of a pressing between interstage annealing could very well give rise to excessive grain growth and consequent loss of ductility, as for example, with some aluminium alloys.

On annealing H.C. copper after rolling reductions in excess of 50 per cent, preferred orientation is developed. During rolling, the grains are deformed in direct proportion to the reduction of the strip, so that with 90 per cent reduction, for example, the grains of the three initial slabs are reduced to average thicknesses of 0.002 mm., 0.004 mm., and 0.006 mm. Also, by and large, the crystal lattice in each grain takes up one or two orientations symmetrically disposed with respect to the rolling plane and direction. On annealing, it appears that if the grains are thick, recrystallization of each grain occurs independently leading to preferred orientation not very different from that of the rolled strip. When the grains are rolled to very thin dimensions, that is less than 0.0015 mm., then, for a final annealing temperature of 500° C., recrystallization in one grain interacts with that in neighbouring grains and a single orientation referred to as the cube-texture is developed.

The critical grain thickness at which cube-texture is formed increases in direct proportion to the absolute temperature of annealing so that the amount of cube-texture increases with (*a*) decreasing initial grain-size and solute content, (*b*) increasing final rolling reduction, and (*c*) increasing final annealing temperature.

Copper strip with a high proportion of crystals in cube-texture orientation has very pronounced directional properties (Fig. 8) which are manifest in drawn cups by severe waviness with crests regularly disposed at 0 deg. and 90 deg. to the rolling direction. Also cube-texture leads to considerable loss of ductility in the same directions. Study of the factors affecting preferred orientation in rolled strip is therefore of considerable importance in connexion with the production of strip for deep drawing and pressing.

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Automatic Feeding of Sheet for SLITTING, OILING AND TINNING

A DEVICE for mechanically feeding tin and black plate to slitters, oiling machines, sheet counters and tin pots, has been developed by the Tennessee Coal and Iron Division of the United States Steel Corp., Fairfield, Alabama. It feeds six slitters mechanically, using sheet-metal feeders manufactured by The Dexter Company Division of Miehle-Goss-Dexter, Inc., Pearl River, New York. Three Dexter-fed machines have been designed for applying oil to black plate to prevent rust. It is believed that this is the only completely mechanical operation of its type.

Tin mill operations leave stacked sheets in an uncounted condition and the company has devised its own automatic sheet counter to eliminate inaccuracies of hand counting. Each line is equipped with a Dexter feeder capable of handling two or three sheets simultaneously.

In automatically feeding slitters (Fig. 1), stacks of sheets weighing about 3,500 lb. are brought to the feeder by an overhead crane and positioned on a stand-by roller conveyor for loading on to the feeder's elevator platform. When the preceding bundle has been fed, the elevator platform is lowered, the empty pallet is removed and the new bundle rolled into place. The elevator then lifts the load to the feeding position whereupon an automatic pile height governor takes over and indexes the load upward as sheets are fed off. In feeding a sheet, suction caps lift the rear edge and a blast of air is blown between it and the pile to complete separation. Suction cups near the front edge then lift and pivot, advancing the sheet between friction rollers which deliver it to the slitter conveyor. When a load has been depleted, the elevator is again lowered for reloading.

All but one slitter are in tandem units and trim two opposite edges at one station and the other two edges at the remaining station. The second station may also be used in slitting sheets into two or more. The single-station machine trims two edges only and may also be used for slitting. Slitters trim 78 sheets per min. The Dexter feeders were originally equipped with mechanisms which would reject double-fed sheets; however, there was no call for these units and they are no longer used. Fig. 2 shows the one remaining hand-fed slitter.

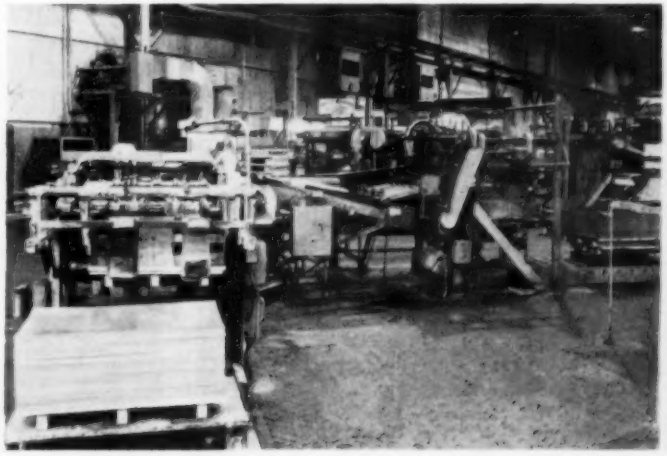


Fig. 1.—One of six automatically-fed slitters at the Tennessee Coal and Iron Division, United States Steel Corp., Alabama. Stacks of tin and black plate are brought to the Dexter feeder by crane, loaded on to its elevator platform, and fed automatically to slitter

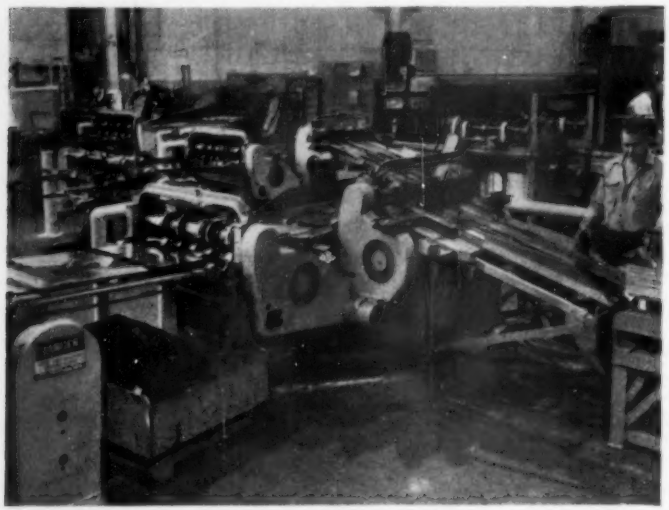


Fig. 2.—Last remaining manually-fed slitter

Oiling Machine

The company's unique method for oiling black plate (Fig. 3) comprises a Dexter feeder, oiling unit, and drying oven. The feeder operates as previously described and delivers sheets to a live-roll conveyor which conveys them through the oiling unit and dryer. A reciprocating spray pipe moves back and forth across the sheets as they emerge from the feeder, spraying them with a mixture of oil and naphtha. The naphtha increases the spreading power of the oil and ensures that it covers the entire sheet. The naphtha is then evaporated in a short drying oven and fumes are exhausted to atmosphere.

Bundles are brought to oiling machine locations by the crane and deposited in temporary storage on wood blocks so that they can be picked up by industrial trucks or by the crane for placement on the stand-by conveyor. Special carriers support the loads when on the roller conveyor and feeder platform. These rectangular carriers are constructed of four pipes, welded at the corners, two on top of the others. This construction provides a sturdy, light-weight carrier which enables the heavy loads to be conveyed smoothly along the roller conveyor and platform. Blocks are placed across the pipes and the load deposited on the blocks. To reduce loading time, one bundle is placed on top of another, and when one bundle is fed off, instead of lowering the platform for the next load, the blocks separating the two bundles are simply removed and feeding continues.

(*Continued in page* 596)

Fig. 3.—Automatically-fed oiling machine. Sheets are mechanically fed beneath a reciprocating pipe which sprays them with a mixture of naphtha and oil. Naphtha is subsequently evaporated in a short drying oven. Three such machines eliminate manual brushing operations

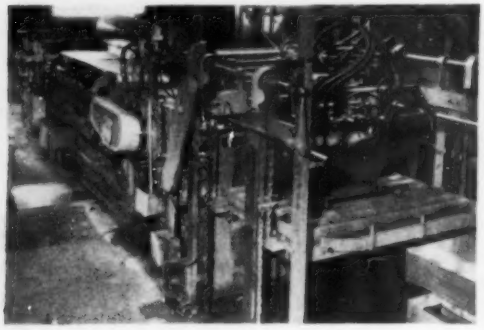
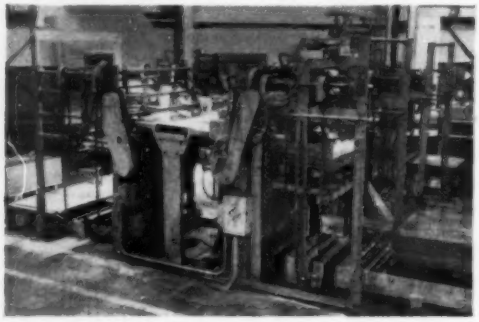


Fig. 4.—Automatically-fed sheet counter. Sheets are fed from pile to conveyor which carries them through photo-electric counter and delivers them to piler



Rocket Motor Chamber Constructed from "Strip-wound" Foil

THE Ryan Aeronautical Company in the United States has recently built a series of rocket chambers capable of withstanding 305,000 lb. per sq. in. wall stress, using stainless-steel foil and a unique spotwelding technique. Light weight has been achieved by a "strip-winding" method in which multiple layers of foil-thin steel strips are spotwelded together.

The company has built and tested a variety of quarter-scale rocket motors and is adapting this research—in which strengths much higher than those achieved in solid wall cylinders have been realized—to full-scale rocket-motor requirements.

Obtaining this high strength required the solution of major problems. One which was successfully overcome was the reduction of stress concentration around the spotwelds through improved spotwelding techniques. Company welding engineers spotwelded together as many as 20 layers of thin-gauge material.

These new spotwelding techniques have overcome a major difficulty in the construction of the rocket chambers, that of attaching end closures of 17-7PH stainless steel, which, welded in place with the new method, successfully withstood the 305,000 lb. per sq. in. stress.



Fig. 2.—Interior of completed rocket chamber and view of spotwelding operations in background

In addition to the utilization of stainless steels, the company will build at least one sub-scale model chamber of titanium alloy.

The new technique of spotwelding together many layers of foil-gauge stainless-steel alloy is the best method of containing the explosive force which is developed in rocket motors. Two methods have been tried, and neither seems suitable. Brazing the layers together introduces extra weight, and temperatures high enough for good brazing weaken the parent metal. Resin bonding of

(*Continued in page* 596)

Fig. 1.—Foil being wound on to mandrel

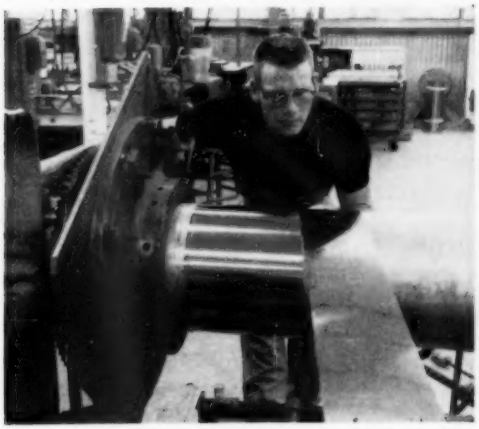


Fig. 3.—General view of completed rocket chambers and spotwelder



Rocket Motors

(*Continued from page* 595)

the layers is not satisfactory, since the layers separate at the high temperatures associated with aerodynamic heating.

The company carried on an extensive search for a material that would meet all the conditions to be found in the construction of these chambers. Metals tested included 17-7PH stainless steel, 301 extra full hard, AM355 sub-zero cooled cold-rolled and tempered stainless (in both the 30 per cent and 70 per cent cold-reduced types), HE-25, PH15-7Mo, and AM 355 cold rolled and tempered. At present being tested is AM355 cold rolled and tempered extra hard, which was unavailable when the other metals were being examined.

Two-ply spotwelded specimens were made from each of these alloys. Specimens ranged in width from 0.3 to 0.750 in. and the number of spotwelds varied from one at the centre of the strip to overlapping spots across the entire width.

Testing included determination of parent metal yield and ultimate strength, Young's modulus and per cent elongation, ultimate strength reduction due to spotwelding, and a strength-to-weight comparison, which was determined by dividing the ultimate strength by the material density.

It was found that these tensile tests, by themselves, were not enough to warrant elimination of any one of the metals. A tear test of the various materials was then made. There is a correlation between the type of tear, the tearing force, and the ability to predict ultimate load on a laminated structure. A straight-line tear, rather than a jagged line, plus a high tearing force are desirable qualities. This test also proved inconclusive, since all the alloys tested tore in a straight line, and all required approximately the same amount of tear force.

The next test was a drop-ball impact test designed to measure the relative brittleness of the metals, and to obtain an idea of their relative ductility. Each alloy was tested to the fracture point, and it was found that AM355 sub-zero cold-rolled and tempered (30 per cent cold-reduced) alloy absorbed the greatest amount of energy prior to failure.

One further test involving all of the metals under consideration was made. Brittle fracture characteristics of each type were determined with the aid of the Mechanics Division of the U.S. Navy Research Laboratory.

When the results of these five tests had been obtained, four metals could be initially selected: HS-25, AM355 SCCRT (both 30 per cent and 70 per cent CR), and AM355 CRT. Because of its density, HS-25 was eliminated, and AM355 SCCRT CR 30 per cent was eliminated because of its relatively low tensile strength. Subsequent testing effort was concentrated on AM355 CR 70 per cent and AM355 CRT.

Research now is in progress in an effort to raise the 300,000 lb. per sq. in. ultimate allowable tensile stresses of laminated structures made of the AM355 series of alloys. This search centres around the modification of resistance welding techniques, including electrode shape and material, current density and wave shape, and weld nugget size.

Automatic Feeding of Metal Sheet

(*Continued from page* 594)



Fig. 5.—One of 16 tin lines, each of which tins two or three sheets simultaneously

Counting Machines

Counting machine (Fig. 4) is made up of a feeder, photo-electric counter and piler. Sheets are fed to the counter, electronically counted, and delivered to the piler. Operation of the counter has justified a second unit. The new counter will be equipped with a late-model feeder capable of delivering up to 150 sheets per min. and supporting loads to 9,000 lb. Present feeders generally deliver less than 100 sheets per min. and support loads up to 6,000 lb. The higher load capacities enable the machines to run longer between loadings. The piler operates in reverse of the feeder, indexing the load downward as it accumulates sheets.

Tin Lines

Each tin line is equipped with feeders capable of feeding two or three sheets to the tin pots simultaneously (Fig. 5), so that each pot may be used to full capacity. Feeders operate as previously described but each machine has duplicate or triplicate sets of feeding mechanisms, all operated simultaneously from the same source. Each group of feeding mechanisms is serviced by individual elevator platforms and stand by conveyors. Plate is stacked considerably higher in this department, each bundle weighing nearly 6,000 lb., and is handled entirely by industrial truck. The higher stacks, of course, reduce the number of loading operations, and result in greater production.

DEVELOPMENT of a SHEET-METAL FUNNEL ASSEMBLY

By "TARENTFORD"

SHEET-METAL construction comes within the uninteresting category to the average layman and such items as trunking, funnels, ducting and tubular details rarely arouse much interest in him. However, much of this work demands experience in many branches of the industry and a comprehensive knowledge of sheet-metal geometry before the final assembly is made.

The funnel assembly illustrated in Fig. 1 is a typical example and comprises a 60-degree cone, a lower cylindrical member, an upper circular ring and attachment angle, and finally a rectangular secondary outlet which is folded and ultimately welded to the main cone an equal distance each side of the centre line. An assembly of this nature gives the impression of simplicity, but the geometry of the cone and rectangular member requires considerable care, and the cut hole and final shape of the box presents profiles not usually associated with so simple a set of details.

The construction of the elevation and plan of the cone is elementary and for simplification each view in Fig. 2 is referred to as A, B, C and D. The first step is to determine the shape of the joint line between the two details, shown on View A as a line passing through the points X to 1, from 1 to 5 and from 5 to Y; once this line is obtained the drawing of the profile in view D and the shaping of the hole in view C is very much simplified.

Having drawn the base circle the next step is to divide the circumference into 12 parts, depending on the size of the curve. A smoother profile is obtained with more divisions, but 12 is a convenient number and gives an ideal distance between each set of lines.

The points on the circumference are joined to O in view B, and projected vertically on to the base of the triangle in view A. At the point of each intersection with the line AG they are then produced to converge at O. In the illustration some of the lines have been omitted in order to make the construction less complicated. The rectangle is added to view B and one short side is divided into a number of parts, not necessarily equal but it is usually more convenient to have them so. These points are numbered 1 to 5 in the illustration with 5 corresponding to H already on the circle. Lines from each point are then drawn to the centre of the circle O and continued to the circumference and the circumferential intersections lettered R, S, T, H, V. The profile of the attachment can now be plotted in view A, and to minimize the risk of confusion, only one construction is described. Taking the point S on the circumference a perpendicular is drawn on to the base of view A

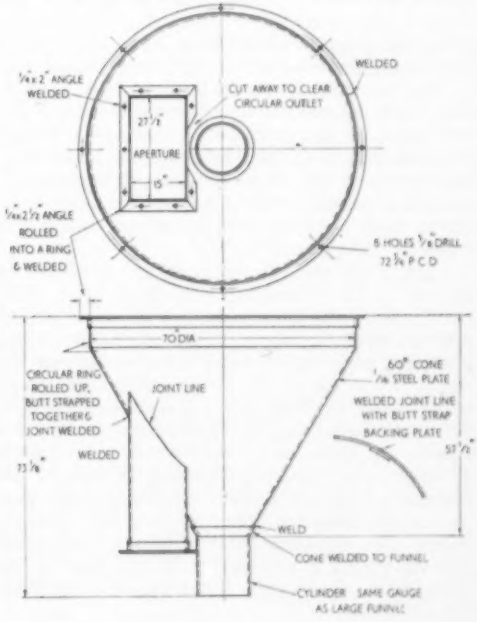


Fig. 1.—A funnel-shaped assembly of this type introduces some interesting layout methods but the setting down is not difficult if the basic principles of radial-line projection are carefully followed

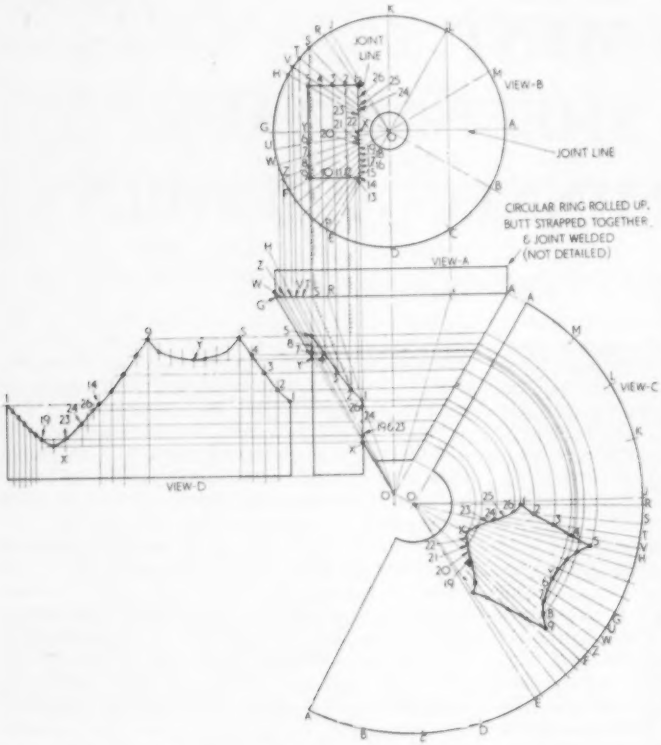


Fig. 2.—The essential details of this layout are broken down in these four views; the drawing of the intersection line between the cone and rectangular outlet in view A is initially determined before proceeding with the remaining parts of the outline

and at the point of intersection, a line drawn to 0. The corresponding point on the rectangle, point 2, is then projected vertically towards O in view A and where it intersects with the line from S is the first point on the profile. All the points on the rectangle and on the circumference are constructed to intersect in view A in this way, thus giving all the points on the profile. It is apparent that lines drawn from points 1 to X and from 5 to Y will complete the rectangle profile.

Some of the work necessary for the development of view C is elementary and thus needs little description. The apex point O is set, a convenient position being 30 degrees to the original point and one joint edge drawn parallel to the side of the cone. The radius OA, which equals the length of the cone is drawn for a length equivalent to the circumference and again divided into the same number of divisions as in view B. Once these 12 points are fixed and lettered as before, the remaining lines are added. Incidentally the joint line of the conical member is along the line OA, making sure the rectangular outlet is cut complete, and the profile is not formed in two sides of the plate, which would occur if the joint line was made from O to G.

The plotting of the points X to 5 from view A to view C is straightforward and only one construction is described to avoid confusion. Using point 2 again for the explanation, a line is drawn horizontally in view A through the point where the perpendicular from 2 and the line from S intersect, to the side of the cone OA, and continued into view C. Then with centre O and radius O2 describe an arc. Where this arc cuts the radial line OS in view C is the new point 2. It is easily seen that by repeating this process for each point in view A a complete profile of the cut out can be built up. It follows that the more points there are in view A the more accurate the result obtained in view C, but it should be carefully understood that in this particular case the rectangle is symmetrical about its centre-line and that in view A points equidistant from the line XY will coincide. For example, point 5 with its radial point H and 9 with its corresponding point F when produced into view A, will intersect at the same point. It is, therefore, only necessary to draw one arc in view C.

The inner section of the profile is built up in a similar manner and it is usually necessary to divide up only one side of the rectangle since the radial lines in view B automatically divide both sides of the figure.

Having settled the aperture for the rectangular pipe the next step is the development of the outlet itself. Point 1 makes a convenient position for the joint line of this detail, and view D is commenced by setting out a base line equal to the periphery of the rectangle. Two vertical lines are then drawn upwards to give I and I. Point 1 on view A is projected across to give the actual intersection points, and having divided the base line at the appropriate positions the same method is adopted for the two high points at 5 and 9. The lower positions in the two curved portions

(*Continued in page* 600)

CUTTING STANDARD SHEETS

Charts for Most Economical Method of Guillotining and Time per 100 Components

By C. F. PEARSE

IT is not surprising that industry is beginning to recognize the importance of the time and motion element in rationalizing costing and improving the many complicated processes encountered in the planning, estimating and work-study fields. Contributions to this field have, however, been few and far between and no serious attempt has been made to standardize the many routine functions of the workshop, particularly that of cutting metal sheet from the time taken point of view.

The two charts, of which a small section of each is shown in Figs. 1 and 2, are probably the first of their kind to be published and it is hoped that in the course of the next year a series of these charts covering a range of standard metal sheets will be available. They have been carefully constructed and are backed by 15 years practical time study experience. They give at a glance the most economical method of guillotining standard sheet, the number of pieces possible from each sheet and strip and the time allowed for the operation in minutes per 100 components. The times quoted have been calculated assuming the operator is working to 100 per cent bonus, which means the actual time taken by an efficient operator is half the figure appearing in the appropriate column. It will also be appreciated that these times may be factored according to operator and shop efficiency.

It is assumed, in this instance, that the sheets being cut are standard 6 ft. by 3 ft., and an allowance has been made in the figures for a trimming cut up to 2 in., so that the final dimensions of the sheet are 70 in. by 36 in.

Chart A, Fig. 1, has been set out to give the following information :—

(*a*) The number of strips per sheet ;

(*b*) The number of components per strip ;

(*c*) The time allowed to cut the sheet into strips per 100 components, including the 100 per cent bonus allowance.

The final dimensions of the component should first be inspected on Chart A, in the following manner, to determine the most economical method of cutting. Let us consider a finished component of 1½ in. by 1 in. It is easily seen that strips of either 1 in. or 1½ in. can be cut. To establish the numerical advantage of one method over the other, locate 1½ in. in the column third from the left, headed strip width and continue horizontally, first to the left, to the column headed strips per sheet, the number in this case being 46. Then continue to the right, until a cutting dimension of 1 in. is directly above. The corresponding number of components per strip is read from the row of figures immediately above the cutting dimension, and is 36. The total number of components per sheet is, therefore, 46 by 36, which is 1,656. If this method is repeated using a strip width of 1 in., the number of strips becomes 70 and the number of components per strip 24, giving a total number of components per sheet of 1,680. From this it is obvious that the most economical way of cutting the components is in strips of 1 in.

Fig. 1.—This chart has been constructed to give the most economical method of cutting and the strip cutting time, in minutes, in terms of 100 finished components

CHART A

C	B	X	Components per strip										
Strips per sheet	Feed to stop	Width of strip (in.)	144	96	72	58	48	41	36	32	28	26	24
			Cutting dimension (in.)										
			¼	⅜	½	⅝	¾	⅞	1	1¼	1½	1⅝	1¾
140	0.14	½	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
70	,,	1	0.11	0.16	0.21	0.26	0.31	0.37	0.42	0.47	0.54	0.58	0.63
46	,,	1½	0.11	0.16	0.22	0.27	0.33	0.39	0.44	0.47	0.57	0.61	0.66
35	,,	2	0.11	0.17	0.23	0.28	0.33	0.39	0.45	0.50	0.57	0.64	0.67
28	,,	2½	0.12	0.18	0.23	0.29	0.35	0.40	0.46	0.52	0.59	0.64	0.69

CHART B

A	B	C	D	Components per strip										
				142	95	71	57	47	41	35	31	28	26	23
Strip width	P/A last piece	Feed to stop	P/U and posn.	Cutting dimension (in.)										
				$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$
1	0.03	0.07	0.03	8.10	8.15	8.15	8.20	8.20	8.25	8.25	8.30	8.30	8.35	8.35
2	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
3	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
4	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
5	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,

Fig. 2.—Chart B gives the additional time, in minutes, required to cut the strips into components

The corresponding time allowed for the operation is given at the intersection of the horizontal line of strip width and the vertical line of the final cutting dimension, but it should be remembered that this figure is already factored for 100 per cent bonus, and gives the time in terms of 100 finished components. In the example quoted the time is 0.63 minutes.

The lay-out of Chart B is similar and the following information is given :—

(*a*) The number of components per strip ;

(*b*) The time allowed, per 100 components, to cut the strips into components.

It will be noticed that on this chart, the width of strip is quoted to the nearest inch, and the number of components per strip does not correspond to the number given on Chart A. This has been done to enable a trimming cut to be made in the event of the strip being distorted.

The time taken to cut the strip into components is again found at the intersection of the horizontal line of strip width and the vertical line of the final cutting dimension. This figure also has the 100 per cent bonus allowance included and gives the time in minutes per 100 components. In the example described, the time taken for this operation is 8.35 minutes.

The total time taken to complete the operation is the summation of the time from Chart A and that from Chart B, and therefore, the total time allowed to cut components 1 in. by $1\frac{1}{2}$ in. is 0.63 plus 8.35, giving 8.98 minutes per 100.

An interesting feature of Chart B is that a formula is given relating columns A, B, C and D. This has been included to enable alterations to be made in the final cutting time, where technique demands changes in the time allowed for putting aside the last piece, feeding to the stop, cutting, picking up and positioning the strip.

The extent of the information given is considerable, Chart A ranging from $\frac{1}{2}$ in. to 20 in. strip width and cutting dimensions of $\frac{1}{4}$ in. to 36 in. The range of Chart B varies from 1 in. to 20 in. strip width and cutting dimensions of $\frac{1}{4}$ in. to $12\frac{7}{8}$ in. As was mentioned earlier in this article, it is hoped that a series of these charts will be available at a later date covering a range of standard sheets.

All purchasing enquiries concerning the sheets described, the cost being 8s. 6d., should be made to C. F. Pearse, 105, Ealing Road, Wembley.

Development of a Funnel Assembly

(*Continued from page* 598)

X and Y are easily ascertained by halving the distances 1 to 14 and 9 to 5, and projecting X and Y from view A. Six major positions are thus fixed on the profile simply by using orthodox projection methods. The remaining points are set down in the same way as dividing the base line into the same number of divisions as used for view B, the distance from 1 to 5 must correspond to that in view B.

The bending and rolling of these details does not present many problems as the rectangular outlet is easily fabricated with the aid of a press or bending brake. The tapering of the cone, however, may present a little difficulty if the appropriate machine tool is not available. Recently the author saw a similar cone being " rolled " on a press brake, a series of lines had been chalked on the plate and the ram descended on each one of these lines using a slightly tapered punch and die. The work was gradually indexed until an almost complete cone resulted ; the gap was closed by pulling the joint edges together and inserting the necessary rivets. While this practice does not produce a very accurate cone, it offers an alternative method of production which is often suitable for this class of work.

The completion of this funnel is achieved by adding the circular top member and cylindrical sleeve attached to the lower portion of the cone, with angle welded to enable it to be bolted to another assembly on site. The assembly was finally galvanized on all surfaces.

The Importance of the Annealing Process in NON-FERROUS TUBE PRODUCTION

Some Details of Works Procedure at Scovill Manufacturing Co., U.S.A.

RECOGNIZING that surface quality, physical properties, and grain-size are probably the most important features of brass or cupro-nickel tube, considerable thought has been expended on annealing processes in use at the New Milford, Connecticut, plant of Scovill Manufacturing Company; Surface Combustion Corporation and Scovill co-operated in designing new heat-treatment equipment. Two key units used for processing brass or cupro-nickel tubing are atmosphere controlled, continuous roller-hearth annealing furnaces. One of the furnaces, located in the "re-draw" line, is direct fired and is 92 ft. long. The other furnace which is convection heated, is 72 ft. long and is located in the finishing line.

The Surface direct-fired furnace (Fig. 1) heats 15,000 lb. of brass or cupro-nickel tubing at temperatures ranging from 375° C. to 820° C. and has facilities within the furnace to pre-cool the tubing to 120° F. (50° C.), using a special pre-cool and fast-cool chamber at the discharge end.

A 15,000-cu. ft. per hour Surface DX generator is used to provide protective atmosphere, when needed. When bright annealing of brass or cupro-nickel tubing is necessary in this furnace, Askania mixers can be set for a richer mix and additional generated DX gas is piped into the furnace. Special precautions have been taken to provide an atmosphere-tight furnace. Both vestibules are provided with baffles to prevent escape of furnace atmosphere and to provide a positive pressure in the furnace. This positive pressure is sufficient to purge the inside of the tubing being processed, thus providing controlled surface conditions on the inside and outside of the tubing.

To maintain surface conditions and proper physical properties, pre-cool and fast-cool chambers are located just inside the discharge end. Tubing placed on the charge table outside the furnace, passes continuously through the heating chamber, pre-cool chamber, the fast-cool chamber, and then to the discharge table.

The rollers on the charge table, in the furnace and on the discharge table are synchronized and driven by a chain and sprocket assembly. This gives uniform speed to the various rollers and provides positive movement of the work through the furnace without damaging the tubing surface.



Fig. 1.—Direct-fired annealing. Discharge end of direct-fired continuous annealing furnace which has a capacity for heating and cooling 15,000 lb. of brass or cupro-nickel tube per hour during general processing

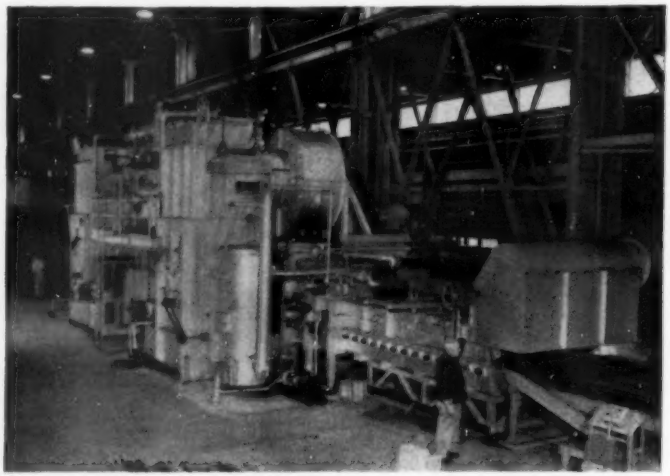


Fig. 2.—Brass and cupro-nickel tube is finish-annealed in this bright annealing convection-heated furnace with capacity up to 8,000 lb. per hour

Four Brown-Minneapolis-Honeywell round chart indicating controllers and a four-point strip chart recorder control the temperatures in the furnace and four Alinor high-temperature cut-off instruments also provide over-heat safety.

A strip chart speed recorder and controller governs the speed of the furnace conveyor. All instruments are mounted on a panel conveniently located near the furnace operator's station.

The Surface continuous roller hearth bright-annealing convection-heated furnace (Fig. 2) located in the finishing line is unique in that it also generates its own atmosphere. This furnace will heat 8,000 lb. of brass or straight cupro-nickel per hour at temperatures between 500° C. to 760° C., and also cools the product to 120° F. (50° C.) before it leaves the furnace. Heat is provided by two separate heating systems outside the furnace. Fans in these two heating chambers circulate the products of combustion through the furnace. In order to provide the continuous supply of atmosphere, the burners in the two firing chambers must be kept firing at all times.

Cooling of the gas is accomplished by passing it through a chamber cartridge made up of beryl saddles. Pre-cooled water passes down through the saddles and the products of combustion pass upward through the saddles coming in contact with the water, thereby providing the proper amount of cooling. Furnace temperature and gas temperature are controlled by two round chart rceorders and a two-point strip chart recorder. Two Alinor high-temperature safety controls are also used to shut down the furnace at 800° C.

Automatic control of this furnace conveyor speed is also by a strip chart speed controller, which indicates and controls the length of time that the material is in the furnace, thereby providing accurate control of grain size.

In both furnaces tubing from 6 ft. long to 60 ft. long can be processed on a full production basis. The maximum length of tubing is dictated by the length of the charge and discharge tables. The minimum length of tubing is controlled by the space between rollers which are on 12-in. centres.

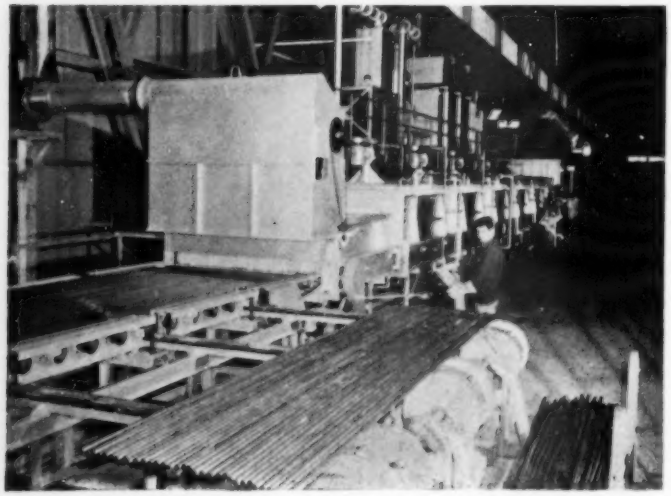


Fig. 3.—Uniform grain-size, related temper and bright clean surfaces of the finished tube, depend on this precision-controlled 9,000 lb. per hour capacity, automatic annealing furnace

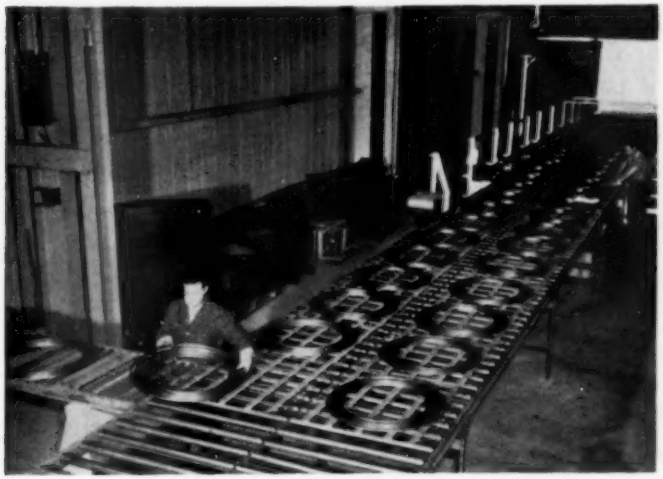


Fig. 4.—Tube supplied in coil form must meet specific soft temper requirements. To ensure uniformity, final bright annealing is done in this closely controlled furnace, after tube has been coiled

Finish Annealing

The furnace equipment (Fig. 3) is used for the bright process and finish annealing of copper tubing in a controlled atmosphere. In addition to handling straight lengths of copper tubing, the equipment is also used to bright anneal single and double pancake coils up to 60 in. O.D. and bunch coils up to 12 in. high (Fig. 4).

The design capacity of the equipment is 9,000 lb. per hr. of straight copper tubing heated to 840° C. The usable hearth width is 70 in. and the loading and unloading tables are designed for a maximum straight tube length of 30 ft.

The straight tubes are conveyed through the furnace directly on the hearth rolls, while the coils are placed on light skeleton-type trays, which ride the roller hearth. The roller-hearth conveyor is equipped with a recording tachometer to continuously record the hearth speed.

The equipment is heated by means of gas-fired radiant tubes and is designed to operate in the temperature range of 375° C. to 900° C. Internal forced circulation fans are incorporated into both the heating and cooling sections to obtain the greatest practical heat exchange rate.

In the foreground of Fig. 3 may be seen the crossover discharge mechanism for straight tubing. As the railing ends of the tubes emerge from the curtained discharge vestibule, the discharge table is lowered and the tubes deposited on the cross conveyor, which carries the tubing sideways off the discharge table. The table then returns to normal position to receive the next tubes. The tubes on the cross conveyor may be picked up by slings or, if desired, may be deposited in the cradle shown by advancing the cross conveyor. This equipment is designed to eliminate any scratching or other marking of the finished tubing.

Also visible in Fig. 3 is the small balcony which is installed along the wall behind the furnace equipment. On this balcony are located the protective atmosphere generation equipment and various other furnace auxiliaries.

The atmosphere equipment consists of an 18,000-cu. ft. per hr. exothermic-type generator, which is equipped with a continuous combustibles recorder and controller to vary the air-gas mixing ratio to

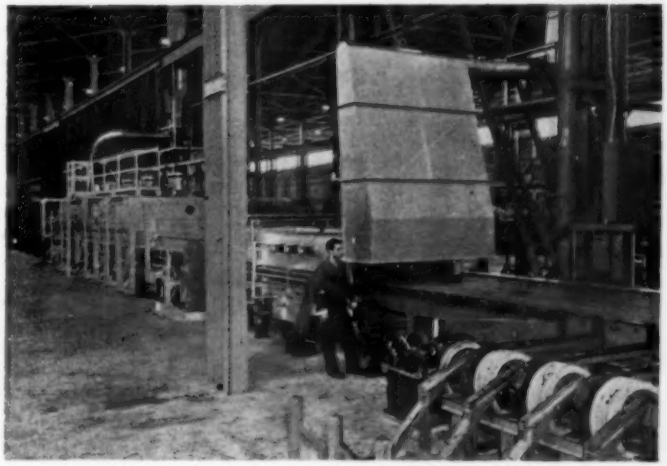


Fig. 5.—Discharge end of direct gas-fired, forced-circulation, roller-hearth furnace for the scale-free intermediate annealing and wet quenching of copper or brass alloy tube. Capacity is up to 15,000 lb. per hour of straight tube length.

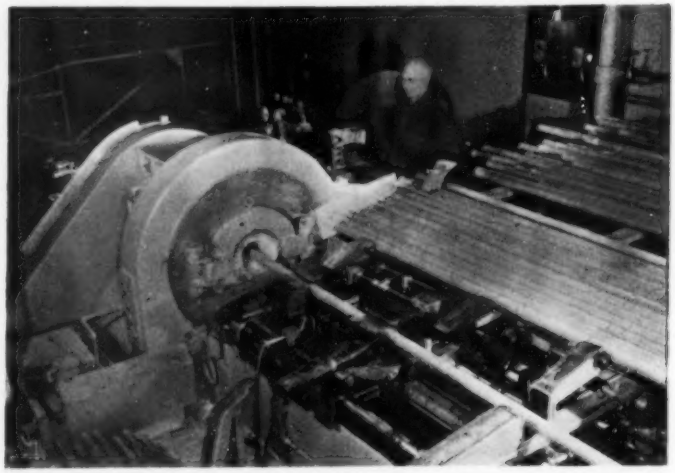


Fig. 6.—These pointers are automatic. Before the drawing cycle, brass "tube shells," too, must be pointed. Scovill developed a special automatic feed-mechanism to speed operations and reduce exhausting manual labour usually involved in this work

compensate for any variation in the fuel-gas composition. Following the atmosphere generator is a refrigerator-type dehumidifier to lower the dew point of the atmosphere gas to 40° F. (4° C.) prior to its introduction into the furnace equipment.

Not shown in Fig. 3 but important operating aids, are a return conveyor to return the empty trays to the charging end of the furnace, as well as the auxiliary petrol engine furnished to continue driving the hearth rolls in the event of a power failure or some other breakdown.

Intermediate Annealing

The equipment shown in Fig. 5 consists of a direct gas-fired, forced-circulation, roller hearth furnace for the scale-free intermediate annealing and wet quenching of copper or brass alloy tubing. The design capacity of the equipment is approximately 15,000 lb. per hr. of straight tubing heated to 700° C.

The usable hearth width is 5 ft. 8 in. and the entire heating section is 38 ft. 6 in. long. The heating chamber is divided into four zones, the first of which is separated from the others by a refractory baffle and is arranged for a high heat input capacity. The furnace burners are located in the side walls, both above and below the work pass line. The burners in the last three zones are of the two-valve premix type. Extreme flexibility in capacity of the furnace is achieved by arranging the piping of these zones so that on low capacity loading the top or bottom burners, whichever desired, may be used independently. This is done by opening or closing shut-off valves, as the case might be, and does not require any ratio adjustment of fuel mixing valves. The furnace is designed to operate in the temperature range of from 375° C.

The second zone is equipped with two forced convection fans, while the third and fourth zones have one convection fan each. The fans provide extreme-temperature uniformity throughout the last three zones even at the lower operating temperatures.

The equipment is provided with a longer than usual discharge throat from the heating chamber to provide slow cooling on leaded brass and bronze tubing prior to the flood quench. Water curtains and other sealing devices make it practical to maintain a non-scaling atmosphere in the furnace, thereby obtaining a bright anneal on copper tubing even at very low firing rates.

Pointing

Pointing is a fundamental operation prior to drawing in the manufacture of brass alloy or copper tubing. This operation has in the past been performed mostly by manual feeding to swagers or large squeeze-type pointers. In the new tube mill, the pointing operations on large diameters of tubing have been mechanized to a point of near automation, completely eliminating the drudgery of manual feeding and with much greater production speed and accuracy.

These modern tube pointers are built around large Fenn Model 7F, four-die swaging machines equipped with an ingenious hydraulically-actuated feeding accessory. Large bundles of tubing are delivered to the feeding accessory platform by overhead material handling equipment. A single operator simply assists each tube length to roll into the jaws of the feeder. The feeder then takes over and the pointing operation is completely automatic, even to the unloading. The pointed pile of tubing is then picked up by the overhead crane and transported to its next operation. No person needs to lift a single tube.

Fig. 6 shows 3½ in. diameter × ⅜ in. wall-thickness tubing being pointed to 1⅝ in. A production speed

(*Continued in page* 616)

A Survey of

GENERAL & SPECIALIZED MACHINE TOOLS for PRESS TOOL PRODUCTION

By J. A. WALLER

(*Continued from page* 148, *February*, 1960)

PILLAR DRILLING MACHINES

GENERALLY speaking the selection of a particular size and type of machine tool is not a difficult task, but with so many different sizes and types of drilling machines which are not, in any case, regarded in a tool room as precision equipment, the selection is perhaps a matter of size coupled with the question of cost.

Fig. 1 shows a bench machine from the range of Alfred Herbert Ltd., Coventry, probably about the smallest drilling machine suitable for tool-work because the drill-size is from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. and the top speed 12,000 r.p.m., a figure somewhat high for the hard steels associated with this work; the stroke is $3\frac{1}{2}$ in. and the radial capacity $6\frac{1}{4}$ in. and machines of 1, 2, 3 or 4 spindles are marketed.

The Progress Model No. 12 of B. Elliott and Co. Ltd. (Fig. 2) has a drilling capacity of up to $\frac{1}{2}$ in. and with a spindle travel of $3\frac{1}{2}$ in.; this is a size which is popular in the shop engaged on the medium press tools; the 4-step vee-rope drive from a motor at the rear, gives a speed range of 460 to 2,900 r.p.m. A distance of $6\frac{1}{2}$ in. from the centre of the column to the spindle centre is included to show the general characteristics of the tool and the $\frac{1}{2}$-h.p. motor runs at 1,400 r.p.m. The finish, as the photograph shows, is black crackle enamel.

Fredk. Pollard and Co. Ltd., of Leicester, are also makers of this type of drilling machine in a slightly smaller version, and Fig. 3 shows a compact driller that will fit into the layout of a shop engaged in light press-tool construction, similar to that associated with the radio-valve industry. In this photograph a single spindle machine is shown, but other machines of two, three and four spindles are manufactured. There is a spindle travel of $1\frac{1}{2}$ in. a chuck capacity of $\frac{5}{8}$ in. and a distance of $4\frac{1}{2}$ in. from the centre of the column to the chuck centre. Speeds available are 2,700 to 4,900, 6,000 to 9,000 and 13,000 to 18,000 r.p.m. obtainable through three interchangeable motor pulleys, and the motor for driving purposes is $\frac{1}{4}$ h.p. Finally, as the photograph shows, the control button is at the front of the machine, and in the case of the multi-spindle drillers, each has a separate button.

Steel pedestals feature in many bench machines and give the drilling head robust characteristics, equal to machines using cast pillars.

Kerry's (Great Britain) Ltd. of Stratford, London, manufacture a machine known as the "Drillmaster," capable of drilling holes up to $\frac{3}{4}$ in. in diameter. It has a chuck capacity of $\frac{1}{2}$ in.,

Fig. 1.—The Herbert Type "J" bench drilling machine for drilling holes up to $\frac{1}{4}$ in. diameter

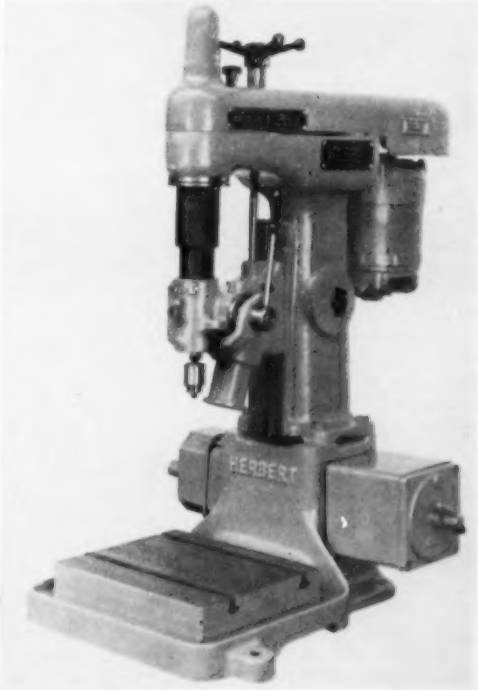




Fig. 2 (above).—The Model 12 bench machine produced by B. Elliott and Co. Ltd. has a table and base on which to stand the various workpieces. The range of speeds makes it suitable for medium-type press tools

a spindle travel of 5 in. and will drill a hole in the centre of a 15½-in. circle. Speeds range from 617 to 3,360 r.p.m. but there is an alternative set from 300 to 2,200 r.p.m., and the distance from the chuck to the base is 15 in.—Fig. 4 shows this machine, and it can be seen that small holes in large details are feasible. Pedestal models of most machines are available utilizing the steel pillar and giving, in this case, a drilling space underneath the spindle of about 42 in.

Another design from B. Elliott and Co. Ltd., their Progress 2G Machine (Fig. 5), follows rather on the same lines as previous examples but with one important difference, *viz.*, a drill capacity of ¾ in. The spindle is bored No. 2 Morse taper for this purpose, and the drill can undertake the machining of comparatively large holes for its size. As there are 10 speeds ranging from 45 to 2,460 r.p.m. or 55 to 2,950 r.p.m., these characteristics place this particular example in a favourable position when this class of tool is being considered.



Fig. 3 (above).—This Pollard machine is a light type of bench driller obtainable with one, two, three and four spindles, each with separate control buttons

Fig. 4 (below).—The Kerry Drillmaster has a chuck capacity of ½ in. diameter with a spindle travel of 5 in. These dimensions and the base and table design incorporate features which make it suitable for most tool-room layouts

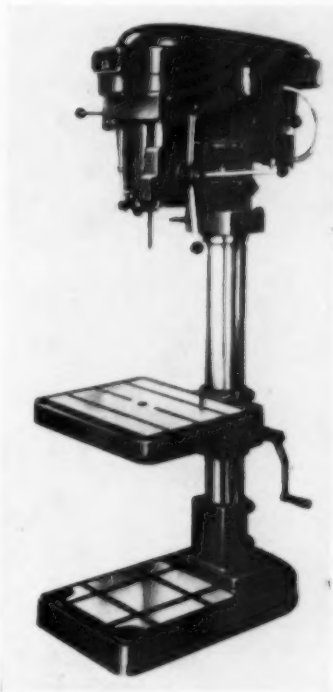


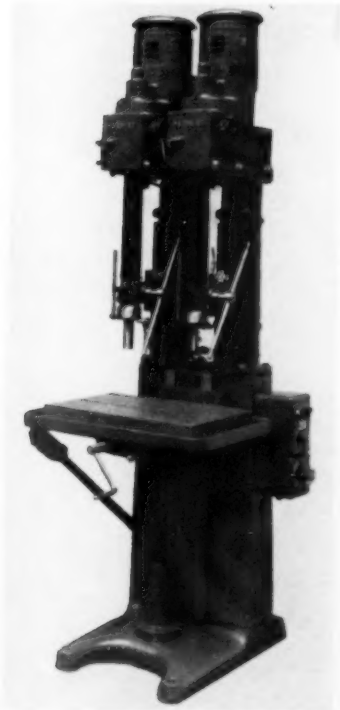


Fig. 5 (top left).—This Elliott machine can drill a ¾-in. diameter hole should the occasion demand. The 10 speeds cover all foreseeable materials, the lower range being useful for recessing, burring and deep counterboring

Fig. 6 (bottom left).—A typical Herbert spindle drill that is in use in every type of workshop. The twin spindles makes it an ideal machine tool for such operations as drilling and reaming, while the elevating table allows the drilling of details normally carried out on the radial machine

Fig. 7 (top right).—The pillar type of driller is popular with both manufacturers and operators, and the design shown here can drill holes up to 1¼ in. diameter. B. Elliott and Co. Ltd. have several designs of this type under construction





Alfred Herbert Ltd. of Coventry also produce these tools and the Type " C " model two-spindle drilling machine (Fig. 6) shows a tool which in general design, has been popular for many years in every type of workshop. The work on this machine is confined to drilling and reaming dowel-holes, drilling clearing-holes for screws and drilling tapping-holes for studs and similar items ; tapping is seldom attempted as it is largely a process performed on the bench and not undertaken with the aid of a tapping head. The spindle taper is No. 3 Morse which means a drill chuck capable of taking about ½-in. diameter drill is used ; the same size shank is adapted to drills of 1¼ in. diameter, making it possible to undertake work normally associated with the lighter type of radial machine.

Four speed and three feed ranges are provided. The former has a maximum of 562 r.p.m. which is low when compared with previously mentioned machine tools, but as most of the articles, other than clamping details, are machined from a tough steel, such a speed is in keeping with those applied for tool work. Both hand and automatic feeding is included in the design and as the figures are 5 in. for hand application and 4¾ when the auto feed is used, the slight variation between them is not sufficient to cause many problems.

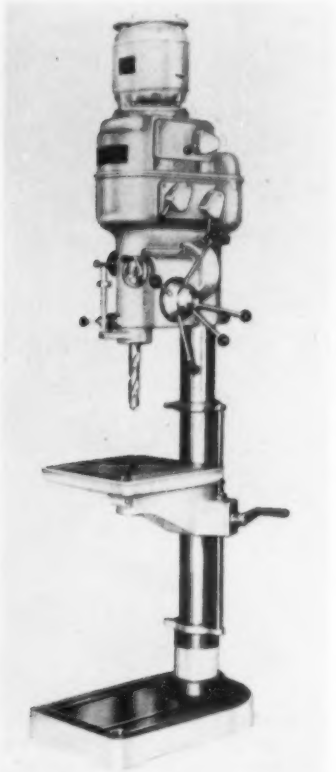


Fig. 8.—This is the Kerry 1¼-in. all-geared-head pillar drill which has nine speeds ranging from 70 to 1,500 r.p.m. This tool is a substitute for a radial driller when the occasion arises

One advantage of this machine is that the table may be adjusted to accommodate variations in work dimensions. A component of about 18 in. length will stand on the table.

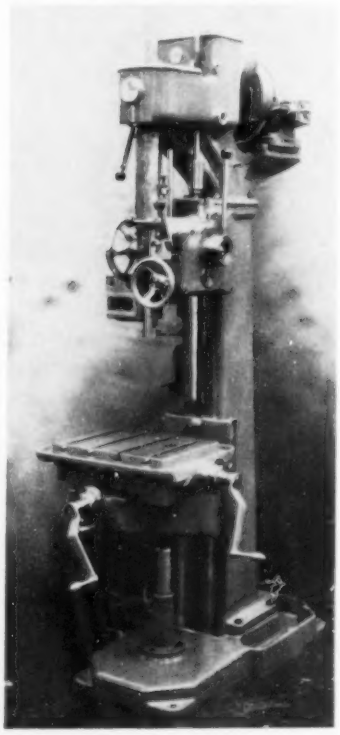
A high-speed pillar-type drilling machine with an adjustable table that can swing round the column to allow a component to stand on the almost floor-level table (Fig. 7), is another product of B. Elliott and Co. Ltd., of London. Some firms prefer this form of construction because it gives more room underneath the drilling spindle to machine details of greater length. Designated the Model 3A, it is capable of drilling holes 1¼ in. diameter. Spindle travel is 6 in. with 10 feeds ranging from 0.004 in. per revolution, and there are five speed ranges which vary according to the type of electric motor specified; these are 70 to 1,180, 90 to 1,430, 110 to 1,780 and 130 to 2,160 r.p.m., the two lower sets of speeds being evidently well chosen for tool work.

A circular table is available, but the rectangular member gives a greater working area, 22 in. by 18 in. against a table diameter of 17½ in. The maximum dimension from spindle to table is 23½ in., the maximum distance from the spindle to the base is 41 in. and 10 in. from the column to the spindle.

Fig. 8 is a 1¼-in. capacity all-geared head pillar drill (No. 125), produced by Kerry's. Though this machine has nine speeds from 70 to 1,500 r.p.m. there are no alternative motor speeds to increase or decrease this number for a particular type of work, but it has the advantage of requiring little floor space, making it ideal for some layouts. A drill capacity of 1¼ in., adequate for normal requirements, coupled with a stroke of 6 in. and power feeds of 0.001, 0.003 and 0.010 in. allows tough steels to be drilled using the automatic feed. A square table or circular member is available, but 14 in. square is a little small for most toolmakers.

Machines manufactured by Fredk. Pollard and Co. Ltd., of Leicester, known as the "Corona" High Speed Machines, include the Type 21 AN

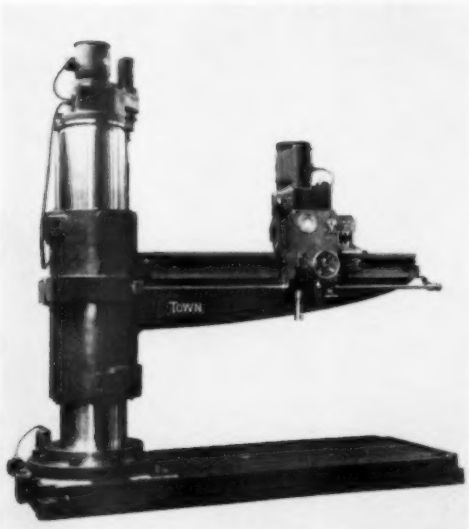
Fig. 9.—This Pollard drilling machine has a sliding head balanced by weights in addition to the elevating table—the latter is also of the compound variety. With nine speeds available this machine thus has several characteristics that will recommend it to many users



machine (Fig. 9). This machine differs from previous examples in that the head lifts as well as the table, considerably increasing the scope of the machine. Being more rugged than previous drilling machines it forms an interesting contrast and is thus worth consideration for tool-room work. Holes of 1¼ in. diameter can be drilled and there are nine speeds available ranging from 52 to 722 r.p.m. but proportionately lower speeds are obtained with the aid of a motor which rotates at 960 r.p.m. Feeds of about 0.005, 0.006 and 0.013 in. are in keeping with the general design, and the table surface of 16 in. by 16 in. is a suitable size for the medium size press tools.

The introduction of a compound table, though not exactly a new innovation in drilling machine construction, is still sufficiently rare as to make it unusual for many workshops. It gives considerable assistance to the tool fitter handling heavy castings or similar parts where numerous holes are needed; a single setting with the part clamped to the table is enough and the table is adjusted to bring the already marked out holes in correct alignment with the drill. The dimensions quoted above for the table surface are for the orthodox type and not for that illustrated in the photograph. Figures for this accessory are 16 in. by 12 in. with a longitudinal traverse of 10 in. and a transverse traverse of 6 in. This shows that though slightly smaller, the coverage is considerably greater.

Fig. 10.—For the heaviest type of press tool this large Town radial driller is an essential item of equipment. As there are seven different sizes of this machine, the range is sufficient to cover all likely requirements



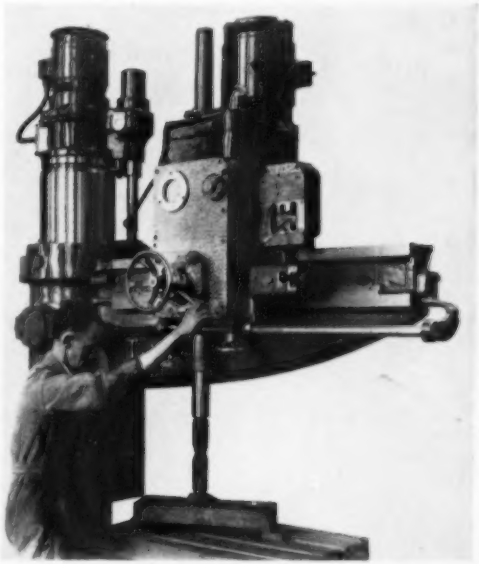


Fig. 11.—A close-up illustrating a smaller version of the Town machine at work on a cast-iron detail. The massive characteristics of the arm and head are readily apparent from this photograph

RADIAL DRILLING MACHINES

From pillar drills to radial drills is apparently an easy stage, but there are as many machines of this class as of the simpler tools. Fredk. Town and Ltd., of Halifax, are noted manufacturers of this plant and their machines are among the largest made. The Model A.E.4 driller is constructed in seven different sizes, and Fig. 10 shows the larger tool having a radius of 8 ft. A machine with this capacity is suited to the shop engaged on the large press tools, and the type of work undertaken is much more elaborate than performed on the pillar machine.

Twelve speeds from 34 to 1,000 r.p.m. indicate the possibilities of these machines, and though the emphasis is on the larger hole (a No. 5 Morse taper is machined in the drilling spindle to accommodate a 3 in. drill), the high speed allows small clearing or tapping holes to be included if necessary without transferring the detail. Only four feeds are used ranging from 70 to 180 cuts per in., but this is not a serious omission as much work of this type is hand fed.

The elevation of the arm is obtained by means of a 2-h.p. motor attached to the top of the 18-in. diameter column. The motor is of the reversing type and is controlled in the orthodox manner by a switch on the saddle, and over traversing is prevented by the incorporation of a safety slipping

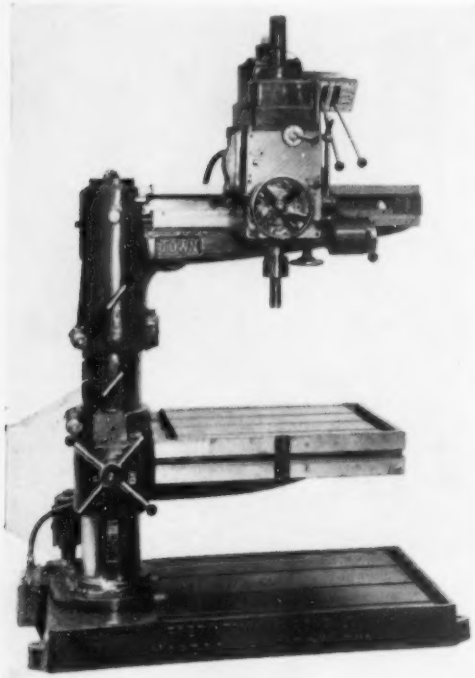


Fig. 12.—Items such as press-tool bolsters are preferably clamped and not subsequently moved. This Town machine is ideal for that purpose

device in conjunction with trip dogs at the top and bottom positions of the arm movement.

On machines of this size, there are occasions when it is essential to bolt the work on to the baseplate, and the illustration shows the large area, 8 ft. by 3 ft. 8 in. available for this purpose.

The close-up view, Fig. 11, shows a smaller machine of this range, drilling a cast-iron base for a tool and illustrates the various handles and handwheels on the saddle. A great deal of time and thought has gone into the design of radial drilling machines of late years and this photograph readily shows the care lavished on this part of the construction.

In Fig. 12 another drilling machine made by this company, the A.E.5 Model is shown; this has a 42-in. radius. The elevating table is 3 ft. by 2 ft. with the sides, machined to a depth of 6 in., allows work to overlap and locate from these surfaces. The baseplate is similar in size, 3 ft. 6 in. by 2 ft. 4 in., indicating that heavy details should be clamped to it.

A No. 3 Morse taper accommodates a 1¼-in. drill and the speed range is 88 to 1,450 r.p.m. There are three feeds of 0.005 to 0.013 in. per revolution and the saddle traverses along the arm for a distance of 2 ft. 9 in.

In close-up the general characteristics of the saddle follows closely those adopted for larger machine described earlier, and the details are very similar. The two long members seen to the right are spindle-speed change levers, the short detail at the right-hand end of the arm and protruding from a cylindrically shaped box, is the spindle stop, start and reverse lever, while the small lever in the centre of the saddle, surrounded by a dial, is the feed change lever. Finally, there are the saddle locking lever underneath the largest handwheel and behind that, the automatic feed clutch lever and the quick hand and power feed engaging handles. There is undoubtedly a use for both machines, as the lighter is easily capable of performing some of the work designated for the larger machine.

The O.D. range of drilling machines (William Asquith Ltd., of Halifax and Shrewsbury) are well known in the machine-tool world and a typical example is shown in Fig. 13. In the family of O.D. machines there are five of the O.D.I. class each varying in different aspects, but all of them have 12 speeds, the range in the slowest machine being 16 to 430 r.p.m. and the fastest 58 to 1,550 r.p.m. With six feeds from 0.004 to 0.038 in.

Fig. 13.—The O.D. drilling machines produced by Asquith Ltd., of Halifax are renowned, and the model illustrated here is one of many suitable for tool-room work

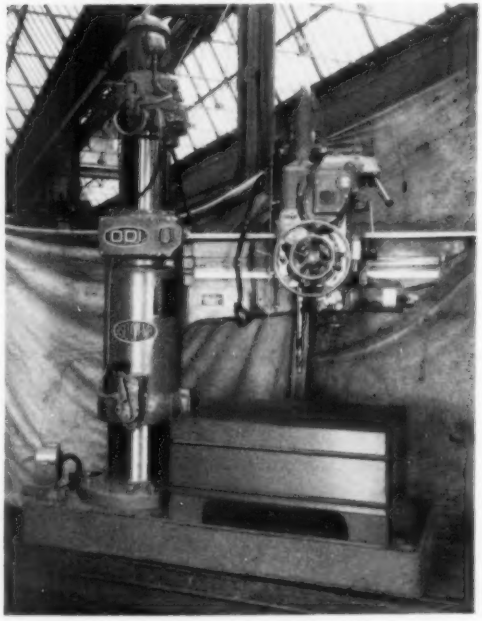
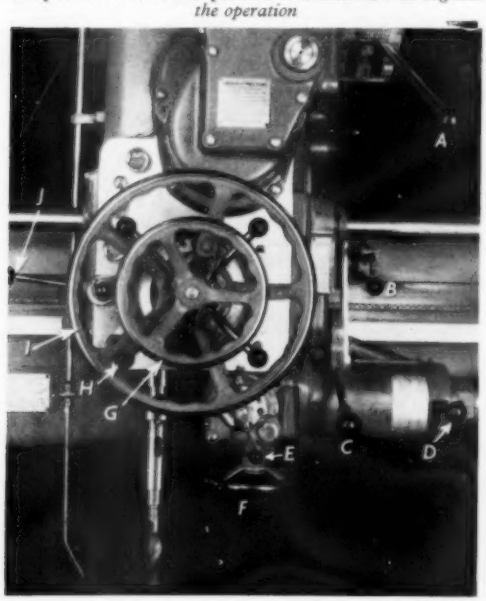


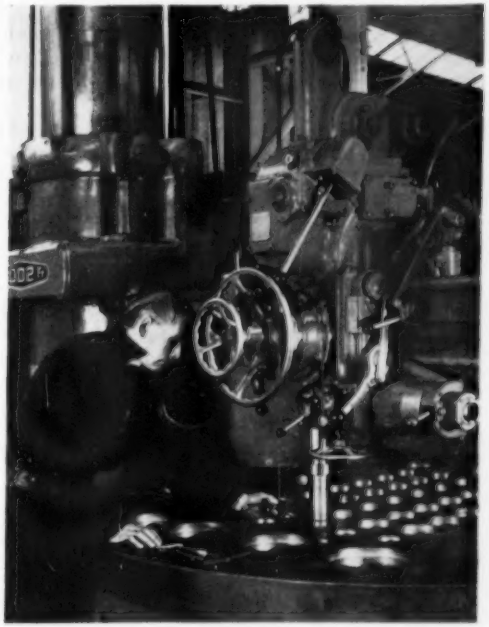


Fig. 14 (*above*).—*An additional locking lever for clamping the arm is a feature of the O.D. machines; this close-up indicates the simplicity of the arrangement*

Fig. 15 (*bottom left*).—*This annotated photograph illustrates the position of the various operating levers. A—Change speed lever. B—Double gear lever. C—This locks spindle slide on the arm and the arm on the pillar. D—Master switch controlling spindle start, stop, reverse, and arm raising and lowering. E—Spindle change speed. F—Fine spindle hand feed. G—Handwheel for spindle slide traverse along arm. H—Star handle by which self acting feed is engaged without bringing tool on to work. Also disengages power feed for tapping, etc. I—Quick spindle adjustment and application of automatic power feed. J—Extra arm lock*

Fig. 16 (*top right*).—*While this photograph does not illustrate a machining operation on a press tool, it nevertheless does show the possibilities of radial drilling machines when specialized boring is necessary. Careful setting together with a securely clamped arm ensure the position is maintained throughout the operation*





they possess machining features not generally provided in this type of tool, a reason why they are so popular. To these are added approximate baseplate dimensions of 3 ft. by 7 ft. and the usual maximum drill sizes specified for these machines.

Further interesting points in the design include the additional locking lever (Fig. 14), for holding the arm; the latter is power operated and in the form of a box installed on the bell end of the arm and coupled to the locking levers inside the arm.

Drilling machines of the radial type have a surprisingly large number of control levers and wheels situated in a comparatively small area as Fig. 15 shows, and the makers suggest that the operator's vision is focused over the whole control area from his normal working position. Another point for consideration is the fact that there are many occasions when the arm is lifted to permit the drilling of a high component which may be clamped to the box table, and this naturally means that the levers are well above an operator's head; generally every gear change or movement requires the operator to work with his hands in a raised position, but this concentration of control does limit the necessary movement to within reasonable distances. The photograph has been annotated to show the function of each operating member, and in common with all these machine tools the most dominating feature is the handwheel seen in the foreground for raising and lowering the spindle. The large diameter is useful in effecting

a momentary withdrawal when drilling deep holes and takes but a second or so to accomplish. Similarly the inner wheel is used for traversing the spindle along the arm when searching for a fresh position on a component.

The next illustration (Fig. 16) though not connected with press-tool manufacture, does show the possibilities of the machines when used intelligently because the status is raised from the role of orthodox drilling machine to the more formidable one of vertical boring machine. In this example the large disc-like workpiece requires the boring of several large holes at intervals and as the work is evidently too large for the vertical or horizontal boring machines, the operation is attempted in this manner. Setting is the important factor in such cases plus, of course, accuracy in the machine's spindle and slides, and the boring of smaller pilot holes to ascertain the correct position is the usual method adopted when an operation of this nature is encountered. Adequate locking arrangements to prevent movement of the arm and slide is essential, coupled with a robust spindle to ensure the degree of finish achieved in these somewhat unorthodox methods is of a high order.

Those firms not requiring a heavy-duty radial drilling machine may find Fig. 17 interesting. Simplicity is the keynote of this design compared with the previous machine, but nevertheless, this tool has a useful range of speeds and feeds coupled with a table capacity suitable for all foreseeable requirements. There are nine speeds arranged in geometrical progression and three alternative ranges are offered to fit the needs of various industries. The speeds are as follows : 90 to 970, 139 to 1,500 and 186 to 2,004 r.p.m. and the suggestion is made that the intermediate set of speeds of 139 to 1,500 are best suited to press-tool construction.

Feeding, though not so important in tool work is provided by three different movements—0.0055, 0.0086 and 0.0125 in. per revolution, and though the latter is perhaps high for the harder and tougher materials that form a major part of this equipment, there are occasions when drilling deep holes in mild steel and cast iron, clearing holes for severed blanks is a typical example, it can relieve the operator of much strain.

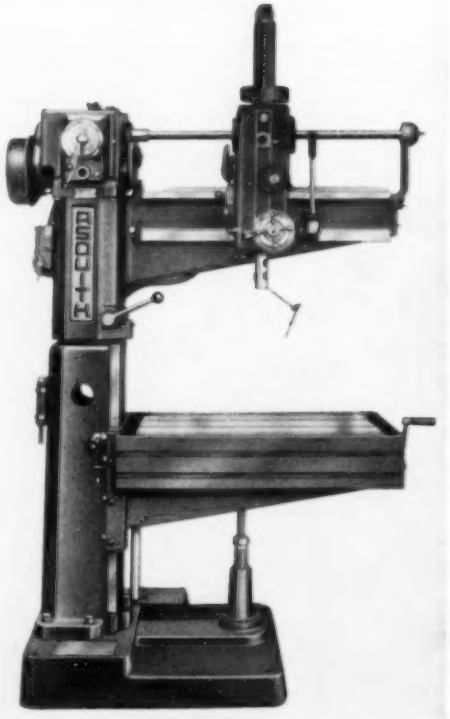
The No. 3 Morse taper conforms to the earlier machines described in this article, and with a maximum spindle radius of 38 in. and a minimum radius of 11 in., it gives greater coverage than the fixed-spindle design. Large bolsters are best left undisturbed after the initial clamping as this saves the operator much effort and reduces fatigue. A table size of 38 in. by 23 in. indicates the type of detail that will clamp to it. The machined side of this table is a useful feature as it gives a cross location that can often assist setting.

No attempt has been made at this point to describe and illustrate the vertical drilling machine with the precision compound table as this type of machine comes within the category of a boring machine.

Tool-fitters find that a pin held in a drill chuck and rotated at high speed is soon reduced in size to fit a particular hole, or a similar lapping process may be performed on a tight die prior to inserting it in the die plate. As a substitute for a press, the drilling machine is useful when initially aligning the top and bottom members, the use of a special stalk to fit the taper hole in the spindle enables a fitter to try the tool and to observe whether the punches are doing their job correctly using a thick piece of cardboard instead of a strip of metal through the material guides. Such an operation is entirely unorthodox but the drilling machine used in this manner can save the fitter considerable

(*Continued in page* 616)

Fig. 17.—A small Asquith radial driller of this type is a useful addition to the tool room engaged on the lighter version of press tool. Despite the apparent simplicity of the design this class of machine is very versatile and comparatively large articles are accommodated on the elevating table when necessary



8

SHEET METAL DATA SHEET

Production of Side Seams

Compiled by J. W. Langton, M.B.E., B.Sc.(Lond.), M.I.Mech.E.

PRODUCTION OF SIDE SEAMS

THERE are two main types of side seam in use in sheet-metal fabrication, the lap seam and the plain lock double seam.

This data sheet is intended to cover the general points in the production of the seams in sheet-metal work generally. While some of the text might cover tin containers these will be dealt with separately in a later data sheet.

Lap Seams

Here the metal at the joint overlaps. Mostly for a satisfactory joint one edge of the seam is joggled as in Fig. 1:



Fig. 1

for one depth just over the metal thickness. The amount of the overlap is somewhat arbitrary, mostly dependent on the method chosen to hold the joint together.

The method possibly in most use is welding, either spot, stitch or seam. Where the joint can be soldered, or brazed these are further possibilities, but mostly confined to tinplate or terneplate in ferrous metals, or copper in non-ferrous. Riveting is almost now obsolete.

Perhaps it should be mentioned that butt welding (*i.e.* without overlap) is sometimes used, but is rather the exception.

Where required, the joggle is produced in some form of pressure tool, operated in angle bender, press or press brake, fitted with a simple joggling tool. This tool should be designed to prevent "bottoming," preferably with the joggle edge of the bottom tool pressure loaded rather than be solid. If the press or whatever being used is not carefully set with a solid bottom tool, variations in metal thickness might cause serious damage. The joggling is, of course, done usually while the metal is in the flat. If this has to be followed by rolling to shape, the joggle is usually undisturbed.

Seam welding is usually the best answer to the joining. If the control of diameter is important, then the welder needs a jig to hold the joint in place, during the welding. Alternatively, the seam can be "locked" by spot welding in a few places before passing to the seam welder.

PLAIN LOCK DOUBLE SEAM

The plain lock double seam may be closed to be an outside seam (Fig. 2b) or an inside seam (Fig. 2a). The production method is the same for both; consisting of the production of the hooks on each edge, followed by the closing or "grooving" of the seam.

For light sheet-metal work, the hooks are plain single hooks (Figs. 2a and 2b). If the side seam is on a corner of a rectangular shape, then the hooks are usually shaped to carry part of the corner radius (Fig. 2d).

The general production methods used for the making of the edges are as follows:

(1) Folding Machines

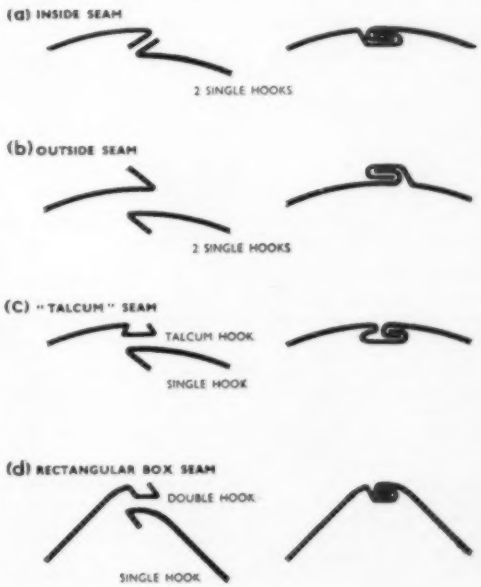
These are mostly used for the shorter, lighter work, where the blank itself is moved by the folding beam *i.e.* on the tinman's folder principle. Where possible the best type of folder to use is the adjustable bar type which has pre-clamping of the edge.

If the blanks are of any size, they take time to handle, so this method is not a very quick one.

(2) Press-tool Methods

The usual type of tool is the plain Vee bending tool, which does mean that the whole of the blank has to be moved during the bending. If this is to be avoided, and if the hook is comparatively narrow compared with the large

Fig. 2.—Standard side seams



8 SHEET METAL DATA SHEET

Production of Side Seams (Cont.)

blank size, then a special press tool with side cam slider can be used.

The hook-forming tool can be operated in one of the following:

Angle Bending Machines

For work up to about 20 gauge, lengths up to 48 in. and small quantities, hand power machines can be used.

Press Brakes and Power Angle Benders

These can be used for greater quantity work, without much practical limitation on size.

In the same way, for shorter work where desirable, a mechanical power press could be used.

As a further alternative, where the sizes are not too great, up to between 3 to 4 ft., special machines for hook forming can be obtained, usually for gauges up to about 20 s.w.g. Where the quantities are of some size, these machines are worth considering, as they not only produce the hooks at a fair production rate, but of even quality which is of importance in making a good seam.

(3) Rotary Methods

The hooks can be produced at speed in what is in essence a section-rolling machine but more often termed, in this instance, a lock former. The usual maximum gauge limitation is 16 s.w.g.

SHAPED HOOK

For the rather heavier gauges, it is usually advisable to shape the over hook of the side seam to be near its final closed form. This reduces the final load or pressure to be supplied by the grooving.

This shaped over hook can be produced in any of the methods previously described for the plain hook, except the folders, *i.e.* by use of pressure or rotary methods.

The same remarks apply to the production of specially shaped under hook required for side seams on the corners of rectangulars.

CLOSING OR GROOVING OF SEAM

The two hooks can be closed or grooved together by (*a*) rotary methods; (*b*) pressure methods.

Rotary Methods

Here the side seam hooks (hooked together of course) are placed over a mandrel and the hooks closed by rolling over them a roller, where axis is at right-angles to the seam.

If the seam is an outside one, the seaming groove is in the closing roller, if inside, the groove is in the supporting mandrel. Usually the mandrel is reversible for inside and outside seams, and most machines supplied have extra rollers with plain and with grooves.

Irrespective really whether pressure or rotary methods are used to close the hooks, the basic principle is the same, *i.e.* the forming of the hook material into the shaping or constraining groove. It thus follows that the width and depth of this groove is very important, be it in roller, mandrel or pressure tool.

The closing rollers may be actuated by hand or power.

Hand Operated Machines

The common length range here is up to about 50 in. and gauges up to 22 s.w.g. The rolls are moved to and fro by rack and pinion, and the pressure given by rolls is adjustable.

Handmachines are slow, particularly on the larger lengths.

Power Machines

These machines deal with lengths up to 6 ft., and gauges up to 16 s.w.g.

A common design is to have the machine mounted in twin pedestals, with the mandrel to swing out. There is usually an automatic release at the end of each forward and return movement.

PRESSURE METHODS

This can be by far the quicker method. The basic elements required are a supporting mandrel for the work and a closing tool or hammer, so that, except on very large work the seam can be closed in one blow.

The elements can be mounted in almost any form of press, from the bar flypress to the large hydraulic or mechanical press.

In addition, special-purpose presses for this operation can be obtained, usually called grooving presses. The usual lengths covered are up to about 50 in. and gauges round about 24 s.w.g.

It is impossible to give any general rule for the pressure required in grooving. Apart from this varying very obviously with stock thickness and length to be grooved, certain other factors, as degree of tightness of seam etc. can seriously affect the pressure.

In tinplate work, in materials up to 30 s.w.g., the closing pressures are of the order of a ton per in. length of seam. In one particular hollow-ware job in 16 s.w.g. the grooving pressure was about 3 tons per in. with over hook pre-formed.

COMBINED HOOKING AND GROOVING

The two major operations can be combined for certain work, using a machine called an automatic side seamer. Here the hooks are formed, placed together and grooved in one cycle of the machine.

This is a machine common in the tin-container industry, but can be used in light hollow-ware, mostly circular; maximum lengths so dealt with are approximately 21 in. and maximum gauge approximately 23 s.w.g.

These machines can be regarded as rapid side seam producers.

As a kind of midway alternative, by use of a special press tool mounted on the mandrel of a suitable press, the seam can be produced in two operations. In the first stage of the tool, the hooks are formed, then placed together and re-inserted in the second stage for the grooving. This tool is sometimes termed a Dutch grooving tool and can be a good answer to the demand for lock seam production in medium quality work.

GROOVING RECTANGULAR WORK

When grooving rectangular work with the seam in the corner the top closing tool needs to be shaped to cover the corner and part of each side.

SHEET METAL DATA SHEET 8

Production of Side Seams (Cont.)

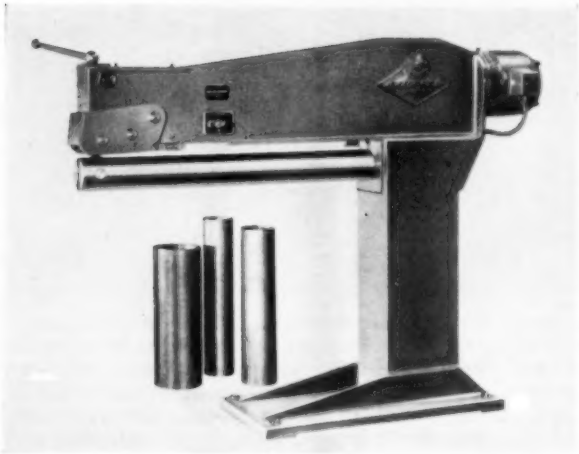
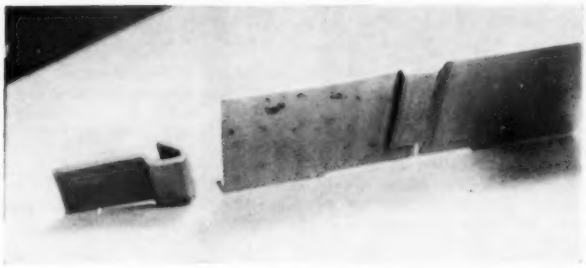


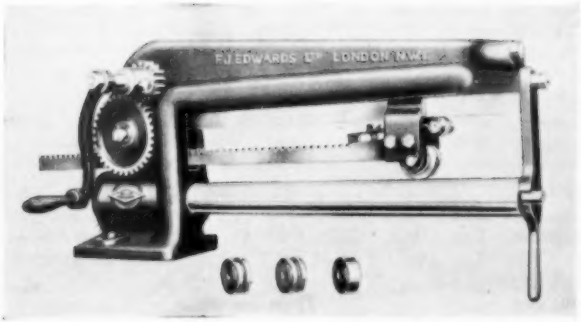
Fig. 3 (left).—Power-operated grooving machine

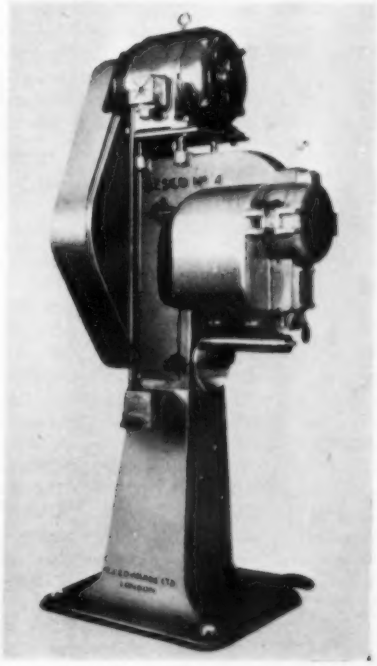
Fig. 4 (left, centre).—Overlap hook and side seam

Fig. 5 (left, bottom).—Hand-operated grooving machine

Fig. 6 (below).—Automatic side-seaming machine







Annealing at Scovills

(*Continued from page* 604)

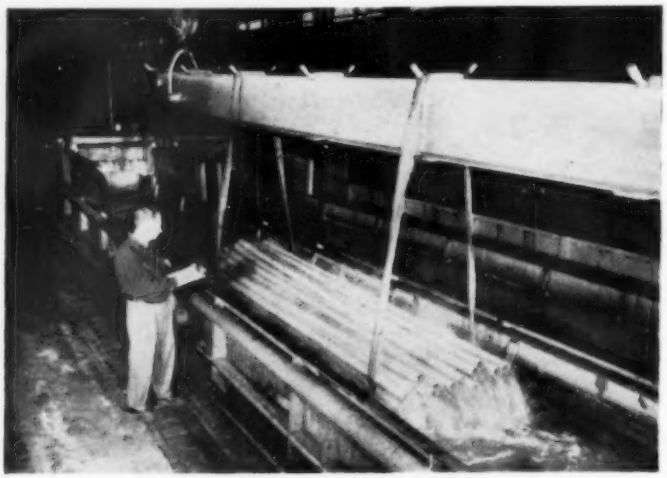


Fig. 7.—Pickling removes surface oxides and drawing compounds. A forced flow of 1,700 gallons per minute in these stainless-steel tanks forces both acid solution and water through and around the tube to ensure complete cleaning inside and outside

of approximately 4 points per minute is being maintained on this large size of tubing. This production rate is far greater than with former methods with obvious advantages in greater production with fewer machines and labour.

Tube Pickling

The fourteen stainless-steel tube pickling and rinsing tanks (Figs. 7 and 8) complete with mechanized raising and lowering equipment at the New Milford Mill were manufactured by The Portland Company of Portland, Maine. "Jessop" stainless-steel plates were used in the fabrication of the three units 24 ft. long, three units 35 ft. long and eight units 65 ft. long. Approximately 100 tons of Type 316 stainless steel and 1½ tons of stainless-steel electrodes were consumed in fabrication of the 14 units. Plates were accurately sheared to exact size requirements on 12 ft. power shears and formed to shape on 12 ft. power brakes. The units were designed by bending large plates to eliminate butt joints and straps that would otherwise have extended the full length of the tanks, thus minimizing welding seams that would have required excessive welding.

Assembly jigs were designed and used for accurate fitting and assembly prior to finish welding. Special welding procedures and techniques were followed to prevent extensive weld strain in the joints and warping and bowling during the welding process.

Press Tools for Machine Tool Production

(*Continued from page* 612)

effort and ensure that the two halves of the tool are pressed together carefully.

Fortunately, tool-room machines do not receive the same amount of abuse as production machines, hence they retain their accuracy over a longer period. A shop having a large radial driller, perhaps two or three pillar machines and a similar number of high-speed bench machines should provide enough machining space for 20 fitters without causing congestion, and unlike a production workshop there is no need to have them arranged at various points in the shop. A drilling section adjacent to the fitting benches makes a preferable layout especially if a large surface plate is also situated nearby for the marking out of massive castings and similar details.

A box table for the radial drilling machine and an equally large angle plate with perhaps a vice is all the heavy equipment required, thus storage is not a serious problem on this section. Clamps are necessary for the radial driller together with the usual long studs, but a cupboard is sufficient for all these minor details.

Finally, few users of these machine tools use the coolant pump which is sometimes provided, despite all the exhortations seen in text books on the subject of coolant for drills. The pump in the majority of workshops is merely a decoration as the fitters prefer to use the time honoured brush and tin can method. The prospective purchaser need, therefore, not order a tool with this fitting.

Acknowledgements

The author is indebted to Alfred Herbert Ltd., Kerry's (Gt. Britain) Ltd., Fredk. Pollard and Co. Ltd., Wm. Asquith Ltd., Fredk. Town and Sons Ltd., and B. Elliott and Co. Ltd. for the information and illustrations used in this article.

To be continued.

SHEET METAL NEWS

FEATURING EVENTS AND PERSONALITIES IN THE INDUSTRY

SIDNEY GILCHRIST THOMAS MEMORIAL

Pioneer Steelmaker Honoured After 83 Years

NO longer is the world pioneer of basic steel making, Sidney Gilchrist Thomas, without honour in his native land. On Wednesday, July 6, a fitting memorial to his name was unveiled by Mr. G. H. Latham, Chairman of the Whitehead Iron and Steel Company and president of the Newport and District Metallurgical Society, in the presence of a large gathering from the steel and allied industries.

The visible memorial takes the form of an obelisk in polished red granite with native blue pennant stone base and walled-in surroundings, bearing a life-like bronze head of Sidney Gilchrist Thomas in heavy relief and a bronze panel recording the successful experiments carried out by him with the assistance of his cousin Percy Carlisle Gilchrist.

In addition there is to be established a Sidney Gilchrist Thomas Trust Fund the income from which will be used first, for the annual award of a cash prize to the authors of any nationality for the best paper of the year relating to the developments in basic steelmaking published by the Iron and Steel Institute, the parent body of the Newport and District Metallurgical Society; second, for the award of travelling scholarships to suitably qualified candidates under the age of 30 to study developments in steel making practice in another country.

To date a total approaching £6,000 has been contributed and a sum of D.M.50,000 (approximately £4,300) has been promised on behalf of the German Steel Industry.

The Achievements of Sidney Gilchrist Thomas

Following the unveiling ceremony, Mr. Latham gave a very succinct account of the achievements of this pioneer of the basic processes.

Sidney Gilchrist Thomas was born in London in 1850, the son of William Thomas, a Welshman, and Millicent Thomas (née Gilchrist), a combination of the Welsh and Highland celt. Mr. Latham regretted that he was unable to claim him as truly Welsh, but thought that friends from the North may consider that his ascent to fame was not impaired by other Celtic strains. As a boy, Thomas showed a strong desire towards applied science, but his father's death, when he was only 17, prevented him from qualifying for a profession. He earned his living as a clerk in Thames Police Court, Stepney, in 1868 and remained there until 1879 *i.e.* until his part-time experimental work at Blaenavon and elsewhere proved successful. The young clerk began to study science privately and attended evening classes in much the same way as part-time students of to-day. During a course of lectures in metallurgy the comment that "the man who eliminates phosphorus by means of the Bessemer converter, will make his fortune" fired his imagination and afterwards this problem became the ruling passion of his life. At the age of 25 Thomas, from his training in chemistry, concluded that dephosphorization of molten iron would only be possible by lining the converter with a basic material such as lime, magnesia or dolomite to withstand additions of lime which had a strong affinity for oxide of phosphorus. Thomas concentrated the whole of his energies on finding a suitable lining for the converter and communicated this "basic" theory to his cousin, Percy Gilchrist, who was appointed chemist at the Blaenavon Steelworks in 1876. At first, Gilchrist was not enthusiastic but the persistence of Thomas prevailed and experimental tests suggested by Thomas were begun in 1877 with crucibles lined with limestone and lime, followed later with a small 6-lb. converter lined with limestone and sodium silicate as a binder. During this year Thomas made arrangements to be away from the Police Courts on Fridays and Saturdays, travelled to Blaenavon on Thursday nights, so that he and Gilchrist could carry out tests over the weekend, and returning to London on Sunday night.

Early in 1878 Mr. E. P. Martin, General Manager of the Blaenavon Works, was admitted to the secret and he at once afforded facilities at the works on a larger scale as well as at the Dowlais Works. A small fixed converter holding 3 to 4 cwt. of metal was erected at Blaenavon and some 50 to 60 "blows" were made. The next step was a series of tests in a 12-cwt. converter, and gradually the essential conditions for the removal of phosphorus from molten iron were determined. As a result, a paper was presented to the Iron and

(*Continued in page* 618)

Memorial to Sidney Gilchrist Thomas at Newport, Mon.



Sidney Gilchrist Thomas

(*Continued from page* 617)

Steel Institute at the Autumn Meeting held in Paris in 1878 entitled "On the Elimination of Phosphorous in the Bessemer Converter," but its importance was not realized and the paper was not read and discussed until the following May meeting. At the Paris meeting, however, Mr. Windsor Richards, General Manager of Bolckow Vaughan and Co. Ltd., Middlesbrough, met Thomas and was so impressed with the importance of the results that he and Dr. Stead, the consulting metallurgist to his company, arranged to visit Blaenavon in October, 1878, to see some experimental "blows" and as a result a series of large-scale tests was arranged to be carried out at their works in Middlesbrough in 30-cwt. converters early in 1879. Success was attained with a durable lining made from shrunk dolomite and tar and low-phosphorous steel was made by means of the "after blow."

The manufacture of steel from phosphoric iron thus became an industrial reality and soon steel manufacturers from the continent negotiated with Thomas for the patent rights for these countries. France, Germany, Austria, Belgium and Luxembourg soon adopted the "Thomas" process as their available ores were particularly suitable. The basic open-hearth process was soon developed as Thomas rightly regarded the use of basic linings as of general application and to-day the vast majority of steel in all countries is made up by the basic process. Thomas recognized the importance of "basic slag" as a fertilizer and concentrated on its application in agriculture up to the time of his early death in 1885 before he was 35 years of age.

World production of basic steel to-day is in excess of 300,000,000 tons per annum, and it is a sobering thought that with the high capacity modern furnaces of to-day the chemistry of steelmaking remains much the same as in the days of the invention of the basic process. Basic linings and lime additions in open-hearth furnaces up to 500 tons, basic Bessemer or "Thomas" converters of 50 tons and oxygen top-blown L.D. converters of 100 tons (which will be installed at the Spencer Works, Llanwern) are still essential features of these processes as in the small converters used by Thomas.

Having referred to Thomas's reputation on the continent where he is recognized as being responsible for the prosperity of their steel industries, what was thought of him in the United States? A visit there in 1881 can only be described as a triumphant tour and he was received with open arms and entertained by the most important people in the American iron and steel world and negotiated the American process rights. Andrew Carnegie said that he was a genius, and that his appearance, manner, dress, voice and gesture all said without saying, "Listen to me, attend. I am not of the routine world, I walk no beaten track: from the unexplored and unknown I bring fruit." Also he said of Thomas, "He had only to appear and we had one of the great men of our generation as our guest." Such are the work and the character of the man whose memory we are honouring to-day which surely must be an inspiration to all young men in the Iron and Steel Industry.

Blaenavon Site

Mr. Latham concluded by thanking Mr. R. Steel of Daniel Doncaster and Sons Ltd. for having provided the site for the memorial and Mr. Newton Davis of H. Davis and Sons (Sculptures) Ltd. for the execution of the design and the erection of the memorial in collaboration with Mr. R. Payne the architect. He announced also that the head of Sidney Gilchrist Thomas had been modelled by the eminent sculptor, Mr. Fred Mancini and cast by the Morris Singer Foundry, London.

Others who spoke at the ceremony were Mr. W. F. Cartwright, president of the Iron and Steel Institute and Mr. R. Steel. Mr. Cartwright alluded to the recent modernization and future plans in the steel industry of this country and expressed the wish that something of the spirit of Sidney Gilchrist Thomas would be evident in the years to come. Mr. Steel said his company regarded it as an honour to have the memorial sited at their works.

Among the others who were present were Mr. W. Barr, Director, Colvilles Ltd., Past President of the Iron and Steel Institute, Mr. K. Headlam-Morley, Secretary, The Iron and Steel Institute, Sir Andrew McCance, Chairman, Colvilles Ltd., Sir Julian Pode, Managing Director, Daniel Doncaster and Sons Ltd., Mr. J. Marcer, Managing Director, Pickford Holland and Co. Ltd., Mr. Arthur Thompson, Chairman, Monmouthshire County Council, Mr. D. W. Puddle, Chairman, Blaenavon Council and Mr. T. G. Grey-Davies, Hon. Secretary, Mr. H. H. Stanley, Chairman and Mr. T. Studley, Hon. Treasurer, of the Newport and District Metallurgical Society.

PRIVATE EXHIBITION OF CONTINENTAL MACHINE TOOLS

CONTINENTAL machine tools are a recent addition to the list of equipment supplied by Henry Pels and Co. Ltd., a company who have been established for many years as builders of sheet metal and plate working machines. An exhibition of these machines, timed to coincide with the opening of the Machine Tool Trades Association exhibition at Olympia, was held at the company's London showrooms in Osnaburgh Street, N.W.1. Two well known German machine tool personalities were present, both of whom had machines on show. They were Dr. Max Meuller, head of Max Meuller Machinenfabrik and Herr Goeschler, head of Wanderer Werke.

International Institute of Welding—1960 Assembly

THE 1960 Annual Assembly of the International Institute of Welding was held by invitation of the Belgian Institute of Welding at Liège, June 13 to 19. The President of Honour was H.R.H. Prince Albert of Belgium, Prince of Liège. The Assembly attracted more than 700 people from 23 countries and took place at the Palais des Congrès, a magnificent and exceptionally convenient setting on the banks of the Meuse.

This was the second visit of the International Institute to Belgium, where its first Annual Assembly was held in 1948 at Brussels.

OBITUARY

Murray: Mr. Gerald Murray, M.Sc., F.I.M., who died on June16, 1960, joined the laboratory staff of Pressed Steel Co. Ltd. in December, 1935, and was appointed chief metallurgist in 1943. He played an active part on many technical committees and was an authority on the subject of deep drawing and the sheet used for this purpose. He was a member of the first committee of the Oxford Local Section of the Institute of Metals and was chairman of the Section from 1955 to 1957.

Mallinson: The death occurred on Monday, June 20, of Mr. Alfred Mallinson, joint managing director of R. Mallinson and Co. Ltd. and Associated Companies, Frank Lister Ltd. of Halifax, Syldale Manufacturing Co. Ltd., Halifax, and Bradley and Burch (Wire Components) Ltd., London. His connexion with the parent company has extended over the past 52 years.

I.C.I. AND ALCOA ACQUIRE ALMIN LTD.

IMPERIAL CHEMICAL INDUSTRIES LTD., Imperial Chemical House, Millbank, London, S.W.1, for themselves and on behalf of the Aluminum Co. of America (ALCOA), have made an offer for the issued share capital of Almin Ltd. the parent company of the Associated Light Metal Industries Group, which has been accepted by over 90 per cent of the shareholders and is now unconditional.

The Almin Group comprises International Alloys Ltd. ; Southern Forge Ltd. ; Warwick Production Co. Ltd. ; Pressoturn Ltd. ; and Aero Controls Ltd It includes the Fulmer Research Institute, which is an independent institution for carrying out sponsored research.

The group is an integrated and balanced organization embracing a wide range of light metals technology, more especially aluminium, including secondary metal and finished products The total assets—about £5 million—will make a notable addition to the ICI-ALCOA collaboration in the aluminium industry in Britain. This was initiated last September by the formation of the jointly owned company Imperial Aluminium Co. Ltd., and was further expanded recently by the acquisition of Invicta Foil Co. Ltd. and the rigid aluninium foil division of the Prestige Group Ltd.

The new owners of Almin Ltd. have indicated that the change will not affect the position of the Fulmer Research Institute as an independent institution for carrying out sponsored research and any such work undertaken will remain strictly confidential to the sponsors.

Atlas Copco to Manufacture in India

FOUR million Swedish crowns (£275,000) will be invested by Atlas Copco AB, in the first stage of building a factory in India. The new plant will be located about 120 miles east of Bombay at Poona, where a number of other Swedish enterprises have built or are building factories.

Negotiations for the establishment of this Indian subsidiary, which will be known as Atlas Copco India (Private) Ltd., have been conducted by Mr. Sture Ekefalk, joint deputy managing director of Atlas Copco AB, Stockholm. As a result of his talks with the Indian Minister of Industry, Mr. Manubhai Shah, it is likely that the latter will open the factory when it is completed.

Chairman of the board of Atlas Copco India (Private) Ltd., will be Mr. Akbar Hydari.

The new factory will produce air compressors and pneumatic rock drills and initially its output is estimated at Sw. Kr. 4,000,000 a year. The firm will work in close co-operation with a number of Indian companies, who will act as suppliers of components, notably diesel engines and compressor bodies. At the start, a number of Swedish machine tools will be employed in the new factory, but they will be augmented by locally built machines, the number of which will be gradually increased as production expands.

The new company intend to start a training scheme for Indian workers and will, therefore, be accepting unskilled labour.

NEW COMPANY IN COLOMBIA TO INSTALL SHEET MILL

ALUMINIUM LTD. has announced that it proposes to expand its fabricating facilities in Colombia in partnership with industrias Metalurgicas Unidas S.A., a prominent Colombian enterprise, and other local capital.

The existing extrusion plant of Perfiles de Aluminio y Cobre Ltda, in which Aluminium Ltd. already participates, will be expanded by the addition of a 1,250-ton extrusion press. In addition, a new company, Alcan de Colombia, S.A., is in process of formation, which will be owned jointly by Aluminium Ltd. and local Colombian capital. This company will undertake the construction of a new sheet-rolling mill in Cali, Colombia. Expansion of the extrusion plant and construction of the new rolling mill will start immediately.

The realization of these two projects will make a very positive contribution to the development of the industrial potential of Colombia, and of the local use of aluminium.

AGENCY FOR GERMAN MACHINES

THE Elgar Machine Tool Co. Ltd. of 172-178, Victoria Road, Acton, W.3, have been appointed the exclusive distributors in the United Kingdom for the range of vertical and horizontal injection moulding machines manufactured by P. Flesch, Altenaer Strausse, 10-12, Ludenscheid, Germany.

Sheet Metal Instrument Cases—Resumption of Production

THE Crittall-Aquafont Group Ltd. are resuming production of standard and special metal casework, a field in which Aquafont Industries were engaged prior to being taken over by the Group some 18 months ago.

The Group's Camden Town factory is tooled up to handle large or small batch production of a wide variety of metal and electronic casework including cubicles, racks, instrument and tool boxes, switchboard panels, etc., in mild steel, stainless-steel and light alloys. It has the capacity, however, to fabricate virtually any type of case.

Production arrangements are under the control of Mr. A. D. Turner, A.M.I.Mech.E., A.M.I.Prod.E., managing director of The Crittall-Aquafont Group Ltd.

ELECTRICAL REPAIR SPECIALISTS MERGE INTERESTS

DOWDING AND MILLS Ltd., Bordesley, Birmingham, 12, industrial electrical and mechanical repair specialists, have acquired the business of Southern Electrical Repairs Ltd., 55, Millbrook Road, Southampton.

Mr. A. H. Sockett, formerly owner of Southern Electrical Repairs Ltd., is to continue as Southampton manager for Dowding and Mills Ltd., and the general administration will be centred on the London branch, 24, White Post Lane, Hackney, E.9, under the management of Mr. P. L. Hollings.

The Southampton branch will maintain a high standard of service and quality for all repairs and operate on a 24 hour basis.

The telephone numbers of the three works are as follows : Birmingham, Victoria 3301 ; London, Amherst 8351 ; Southampton 20695.

CRODA TURN TO SCANDINAVIA

MR. E. S. LOWER, technical director, and Mr. N. R. Kirkby, general sales manager, of Croda Ltd., recently sailed for Scandinavia to liaise with the company's agents in Norway, Sweden and Denmark and to investigate the market there for Croda's range of fine chemicals, surface active agents, rust preventive oils and coatings.

WOLF DIRECTOR VISITS CANADA

MR. J. A. JACKSON, works director of Wolf Electric Tools, flew to Canada recently on a ten day's business visit to the company's branch at Toronto.

The Wolf Branch, established in 1950, moved into new and larger premises at 93, Advance Road, Toronto, a year ago. Under the continued leadership of Mr. R. G. J. Nisbet, also a director of Wolf, Canadian demand for Wolf industrial industrial and domestic power tools is rapidly expanding.

TROPICALIZED ELECTRODES

AN experiment carried out by Rockweld Ltd., Croydon, Surrey, has proved that their Tropicalized Flexend electrode can resist moisture and remain usable after prolonged exposure to abnormal weather conditions.

The experiment was arranged by Rockweld agents in Malaya, this country being chosen because its humid atmosphere provided an excellent testing ground. With two normal electrodes, a Flexend electrode was left in the open, covered only by a small metal roof. The electrodes were left for six months, and in that time were subjected to a complete cycle of humid conditions. At the end of this period the two normal electrodes had acquired fungoid growths and extensive cracking had taken place. The Flexend electrode, however, was completely unaffected. It was returned to the Rockweld factory in England, where it was satisfactorily used for welding.

Tropicalized Flexend was produced as a result of intensive research to find an electrode which would be more moisture-resistant than existing electrodes. In addition, it is claimed to give a smooth, non-spatter finish. It may be used in any welding position on plate up to 40 tons tensile strength. It is a solid extruded, down-hand, vertical and overhead electrode. The slag is of the quick-freezing type which leaves a clear welding pool and allows ease of manipulation. The composition of the slag ensures a sound deposit, elimination of undercut and, on cooling, the solidified slag removes cleanly and without effort.

Three electrodes, referred to above, after test

New Premises for Stockholders

THE firm of Cashmore Sparrow (Steel Sheets) Ltd., accredited stockholders for the Steel Company of Wales, have acquired premises at the Woodend Mills, Mossley (Lancs). The new premises will be used as a centre for distribution in the North of England and Scotland.

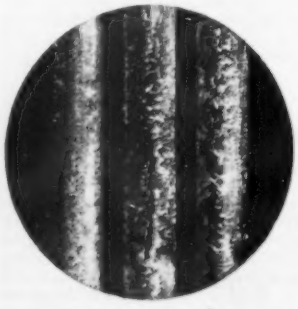
Cashmore Sparrow Ltd. is associated with John Cashmore Ltd., of Newport and Tipton, and also with Robert Cashmore and Sons Ltd., of Wolverhampton.

On land adjoining the present building which is now being fitted with machinery for stocking, shearing and sorting steel sheets, the company will later build more sheds. It is hoped that eventually the depot will be handling upwards of 100 wagon loads of steel sheet a week.

FLAME CLEANING FOR THE REMOVAL OF MILLSCALE FROM STEEL

REMOVAL of millscale from ships under construction at Kingswear, Devon, according to a report from British Oxygen Gases, is carried out by flame cleaning to meet the owners' specified requirements. Among the vessels recently completed are two Trinity House lightships, an Irish lightship, and an Irish lighthouse tender, all of which had the hulls flame-cleaned before launching; this involved cleaning 12,000 sq. ft. of plating on each lightship and the consumption of more than 31,000 cu. ft. of oxygen and acetylene during each operation.

It is recognized that flame cleaning before painting is one of the most effective means of removing millscale and for preparing metal surfaces and many owners in shipyards throughout the United Kingdom now specify this treatment on hulls under construction.



INSTITUTE OF METALS AWARDS

THE Council of the Institute of Metals announces the following awards:

Institute of Metals (Platinum) Medal for 1960 to Professor Robert Franklin Mehl (Head, Department of Metallurgical Engineering, Carnegie Institute of Technology, Pittsburgh) in recognition of his outstanding contributions to the science of metals and to metallurgical education.

Rosenhain Medal for 1960 to Professor Norman James Petch (William Cochrane Professor of Metallurgy, King's College, University of Durham) in recognition of his outstanding contributions in the field of physical metallurgy.

W. H. A. Robertson Medal and Premium for 1959 to Dr. Maurice Cook and Mr. E. Swainson (formerly Chairman and Assistant Manager, Technical Department, respectively, Imperial Chemical Industries, Ltd., Metals Division, Witton, Birmingham) for a paper on "Arc Melting of Reactive and Refractory Metals," published in the *Journal of the Institute of Metals*, 1958-59, Vol. 87, pp. 161-173.

Speeding up Cold Galvanizing

A NEW anti-settlement agent has been introduced into Rust-Anode, the anti-rust cold galvanizer made by C. and P. Development Co. of Redhill, which reduces the time taken in stirring before application. Tests have been carried out by the makers continuously for nine months and tins of the rust-anode have shown no appreciable settlement after being allowed to stand for over 75 days.

Rust-Anode is a metal coat that is applied to steel surfaces by brushing, spraying or dipping and leaves a coat of pure zinc which is strongly adherent, ageproof and rustproof. Application is simple and can be executed on the site without the necessity of dismantling or skilled labour. It can be applied as an undercoat for paint to provide additional protection, dries to touch within 30 minutes and is dry enough for further treatment after 24 hours. It is non-inflammable and will withstand temperatures up to 400° F. The new additive has no effect on the zinc and the rust-anode dries harder than before.

SUPPLY HOUSES TO SELL ELECTROPOLISHING PLANT

M.E.P.P. LTD., the electropolishing specialists who are the exclusive licensees for the processes developed by Battelle Institute, U.S.A., the Jacquet-Hispano Suiza Group of France and the Elektrolyse Gessellschaft m.B.H., Germany, have recently concluded separate agreements with W. Canning Ltd. and R. Cruickshank Ltd. by which the three companies will supply the complete range of solutions, standard plants and specially designed equipment offered by M.E.P.P. Ltd.

M.E.P.P. Ltd. is the only organization in the U.K. offering a complete range of plants and chemicals for electropolishing ferrous and non-ferrous alloys, which have been proved under production conditions for over ten years in polishing and deburring stainless steel, stainless iron, brasses, gilding metals and aluminium alloys. Continuous progress by M.E.P.P. within its international group of companies has resulted in a substantial demand for its ready-mixed chemicals and standardized plants and more recently there has been a wider scope for large units. The use of fully automatic and semi-automatic machines is envisaged in the immediate future and the wide experience of W. Canning and R. Cruickshank will be utilized in their design and manufacture.

Demonstrations of standardized plants and treatments will be provided at the headquarters of each company.

BRITISH LIAISON WITH AMERICAN METAL-FINISHING INTERESTS

WHILE visiting England and Europe recently, Mr. A. C. Benning, technical manager of the electroplating division of Harshaw Chemical Co. of Cleveland, Ohio, and a director of Harshaw Chemicals Ltd. of Waltham Cross, Herts., took the opportunity of addressing the Midland sales and technical staff of the latter company at a sales conference held in Birmingham and dealt with the present situation in the American electroplating industry and recent developments in techniques and applications. Among those present were Mr. T. I. Williams, managing director of Harshaw Chemicals Ltd., Mr. J. W. Weaver, sales manager and Mr. R. T. F. McManus, technical manager.

£½M. STEEL-MILL CONTRACT

CONTRACTS for rolling-mill drives valued at nearly half-a-million pounds and totalling 14,000 horsepower have been obtained from steel companies by the heavy plant division of Associated Electrical Industries Ltd. Motors accounting for half this horsepower will be installed in the Stocksbridge (Sheffield) works of Samuel Fox and Co. Ltd. The other orders are from the Head Wrightson Machine Co. Ltd., and the South Durham Steel and Iron Co. Ltd.

Samuel Fox and Co. have ordered a 5,000-h.p. direct current motor, auxiliary motors, and control equipment for a new 40-in. hot reversing mill. The main drive for this mill will be supplied from a mercury-arc converter installation which has already undergone successful tests in the company's 4,000-h.p. reversing billet mill. For the 40-in. mill, the converter installation will be uprated from 3,200 to 4,000 kW.

A.E.I. Heavy Plant Division is also to supply a 2,000-h.p. motor and control equipment for a 27-in. retractable mill at the Stocksbridge Works.

The order from the Head Wrightson Machine Co. Ltd., on behalf of Tubes Ltd., is for the main drive, consisting of two 2,000-h.p. motors, for a piercer and elongator in the seamless-tube mill at Kirby Muxloe near Leicester. This order includes mercury-arc rectifiers and control equipment. Similar A.E.I. plant was installed several years ago at the same works.

The South Durham Steel and Iron Co. Ltd. has ordered a 3,000-h.p. direct current drive for a finishing stand of a new universal beam mill.

With the exception of the mercury-arc rectifiers, which will be constructed at the A.E.I. Works at Rugby, the equipment for these contracts will be manufactured at the A.E.I. Works, Manchester.

DEXION NEW FACTORY

THE new factory for Dexion Ltd. standing on an eight-acre site at Hemel Hempstead, was officially opened recently by Mr. J. Allason, M.P. for Hemel Hempstead and will concentrate the production, previously spread over three factories, of Dexion slotted angle, open steel plank, shelves and accessories for home and overseas. The new premises occupy 150,000 sq. ft. of floor space; five of the eight acres have been developed and the company has the option on a further eight acres. Also housed at Hemel Hempstead are the Dexion Group's Plastics and Timber divisions which produce Undulite, glass-fibre reinforced plastic sheeting, and Tecton engineered beams.



APPOINTMENTS and STAFF CHANGES

Mr. H. A. Andrews has been appointed general manager of **Power Auxiliaries Ltd.** During his 21 years service with The Plessey Company Ltd. Mr. Andrews has been closely connected with the aircraft industry and during the past year has been responsible for co-ordinating certain of the company's activities in that field.



Mr. H. A. ANDREWS

The **Aluminium Development Association** announces that General Sir Geoffrey Bourne, K.C.B., K.B.E., C.M.G., has been appointed director-general to succeed Air Commodore W. Helmore, C.B.E., who recently retired after 14 years as director-general of the Association.

General Bourne has been A.D.C. General to the Queen since 1959. He was educated at Rugby and the Royal Military Academy, Woolwich, and was commissioned into the Royal Artillery in 1923. After a distinguished war record he became G.O.C. Berlin (British Sector) 1949-51 and was Commandant of the Imperial Defence College 1958-59.

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Head Wrightson and Co. Ltd. have appointed Mr. G. Jones as managing director of Head Wrightson Stampings Ltd. and Mr. W. H. Mather managing director of Head Wrightson Machine Co. Ltd., with Mr. G. Gowthorp commercial director.

The following appointments are announced by **Firth Cleveland Steel Strip Ltd.,** Locarno Road, Tipton, Staffs., a member of the Firth Cleveland Group :—

Mr. K. A. Smith has been appointed to the full board as production director. Mr. Smith was formerly an executive director and works manager.

Mr. D. R. Moylan (contracts manager) and Mr. C. D. Gladwin (chief inspector and metallurgist) have been appointed executive directors.

Mr. G. F. Wright has been appointed assistant contracts manager, and Mr. A. J. Braddock assistant works manager.

Mr. E. F. Ellis is now sales manager, midlands and south west area. The export sales department is now under Miss D. Groom.

Mr. H. Terry has replaced Mr. E. J. Andrews as purchasing officer. Mr. Andrews is now midlands sales representative.

Mr. H. J. Hyett has been appointed personal assistant to Mr. E. W. Day, sales director.

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Mr. R. W. Harris has been appointed works director of the British lock and hardware division of the **Yale and Towne Manufacturing Co.** and of **E. Tonks and Sons Ltd.** of Willenhall, Staffordshire.

Mr. Harris is 47 and joined Yale and Towne as works manager in 1954. In his new appointment he will be responsible for co-ordination of purchasing, design and development, standards, as well as entire production of all Yale and Etas locks, door closers and builders' hardware.

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Mr. T. H. Kelsey, whose appointment as assistant general manager of the Witton Engineering Works of **The General Electric Co. Ltd.,** was announced in October, 1958, has now been appointed deputy general manager to Mr. J. J. Gracie, director of the company, and general manager of Witton Engineering Works.

The industrial division of **Wakefield-Dick Industrial Oils Ltd.,** a member of the Castrol group of companies, have appointed P. H. Cripps as their regional sales manager for London and the Home Counties.

Peter Cripps, who is 40, joined Wakefield-Dick in 1947 and was appointed a representative in the London area in 1954.



Mr. P. H. CRIPPS

Mr. W. E. Duckworth, M.A. (Cantab.), A.I.M., has been appointed head of the metallurgy (general) division of the **British Iron and Steel Research Association.**

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Bristol Aerojet Ltd., the Anglo-U.S. company which makes the majority of British solid fuel rocket motor cases, have appointed Mr. A. G. Shove, A.F.R.Ae.S. as sales manager. Mr. Shove is 41 and has been engaged in the aircraft industry since 1936 when he joined Airspeed Ltd. as an apprentice; he joined Blackburn and General Aircraft Ltd. in 1953 and Napiers in 1958.

Mr. A. G. SHOVE





Mr. R. A. LAKE



Mr. D. J. JONES

Richard Thomas and Baldwins Ltd. have made the following appointments to the production and administrative staffs of the Spencer Works now under construction at Llanwern, near Newport, Mon.:—

Mr. R. A. Lake, chief engineer; Mr. A. J. Burgess, iron-making engineer; Mr. D. Gray, ore preparation and sinter-plant manager; Mr. M. Morrison, chief civil engineer; Mr. D. J. Jones, cold-mill manager; and Mr. F. R. Gillett, manager, central control and planning office.

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Mr. Glenn M. Herring has been appointed assistant to the vice-president, sales, to the **Hanson-Van Winkle-Munning Co.,** Church Street, Matawan, New Jersey. In his new capacity, Mr. Herring will assist in general sales management under Mr. R. M. Norton and will also continue in the management of the Eastern sales district, with headquarters at Matawan.

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Mr. G. Ronald Pryor (chairman and managing director of Edward Pryor and Son Ltd., Sheffield) has been elected president of the **Institution of Production Engineers** for the period 1960/61. The vice-president for the period will be Mr. Harold Burke (group joint managing director of the Concentric Manufacturing Co. Ltd., Birmingham). Mr. R. H. S. Turner (director and works manager of Associated Electrical Industries (Manchester) Ltd.) takes office as chairman of the council, and the vice-chairman will be Mr. A. L. Stuchbery (chief technical engineer of the Metal Box Co. Ltd.).

* * *

Mr. Neil Fenwick has been appointed sales promotion manager of **W. G. Pye and Co. Ltd.,** Granta Works, Newmarket Road, Cambridge.

The **Board of Trade** has appointed the following to be chairmen and members of the Industrial Estates Management Corporations for England, Scotland and Wales, which have been set up under the Local Employment Act which came into operation on April 1.

England:

Chairman: Mr. S. A. Sadler Forster, C.B.E., D.C.L., J.P., F.C.A. *Members:* Mr. W. H. Carder; M.B.E., B.Sc., F.R.I.C.S., F.A.I., Mr. C. A. F. Hastilow, C.B.E., M.Sc., B.Com., F.R.I.C.; Mr. L. Poole, J.P., F.B.S.I.; Sir Richard Yeabsley, C.B.E., F.C.A., F.S.A.A., F.S.S.

Scotland:

Chairman: Sir Robert A. Maclean, C.A. *Members:* Mr. W. I. French, D.S.O., O.B.E., T.D., C.A.; Mr; W. C. Kirkwood, O.B.E., M.C.; Mr. A. D. MacKellar, O.B.E. Mr. J. C. Pinkerton, C.B.E., M.C., J.P., B.L., F.R.I.C.S.

Wales:

Chairman: Captain H. Leighton Davies, C.B.E. *Members:* Mr. L. J. Corbett; Mr. R. C. Mathias, M.B.E.; Mr. E. J. Powell, C.B.E., M.I.C.E., M.I.Mun.E.; Mr. F. E. Price, F.S.A.A., A.I.M.T.A.

* * *

Mr. C. G. Martin, works manager of the Treforest ceramics factory of K.L.G. Sparking Plugs Ltd., has been elected chairman of **Cardiff and District Productivity Association,** of which he has been an active member for several years.

Mr. Martin has been particularly interested in the operation of the Circuit Scheme, whereby in rotation groups from various types of factories visit each other to study methods and exchange ideas.

* * *

Mr. S. A. Roberts, managing director of the B.S.A. tools division, has been appointed a director of **The Birmingham Small Arms Co. Ltd.,** the parent company of the B.S.A. Group.

He joined B.S.A. in 1953 as general manager of the tools division and later became deputy managing director. His appointment as managing director was announced last year.

* * *

Mr. Tom West, who for the past 2½ years has been press and publicity manager of E.M.I. Electronics Ltd., left recently to take up a new appointment with the **Fairbanks Whitney Corporation** of New York, who, under a new arrangement, will be marketing the company's products throughout the United States. Companies in the Fairbanks Witney group manufacture products ranging from diesel electric locomotives and electric power generators, to engine accessories and missile components.

TONNAGE ACETYLENE PLANT FOR IRELAND

THE Carbide Industries' new factory at Maydown, near Londonderry, was officially opened on June 15 by Lord Chandos, chairman of the Northern Ireland Development Council. It is the first acetylene and calcium carbide plant to be built in Northern Ireland and the first "tonnage" acetylene plant in the United Kingdom. Initially the principal outlet of the new plant will be acetylene for the nearby du Pont neoprene factory and it will begin by producing about 50,000 tons of carbide per annum, the bulk of which will be converted to acetylene; to cope with the raw materials (coke and limestone), which will be imported by sea, a wharf has been specially built at Lough Foyle and the materials will be conveyed thence by a half-mile long aerial ropeway to the factory stockpile area, where they will be automatically weighed and fed in a proportion of one to 1.6 on to a conveyor belt to hoppers above the furnace. The carbide furnace was supplied by Electrokemisk A/S of Oslo, and operates on the submerged arc principle; the rest of the plant was designed and built by the British Oxygen Engineering Ltd. of Edmonton, which, like Carbide Industries, is a member of the British Oxygen Group.

The site covers 60 acres but so far only 25 acres have been developed; the total number to be employed is 300.

MAJOR STEEL INDUSTRY ORDER FOR HEAD WRIGHTSON

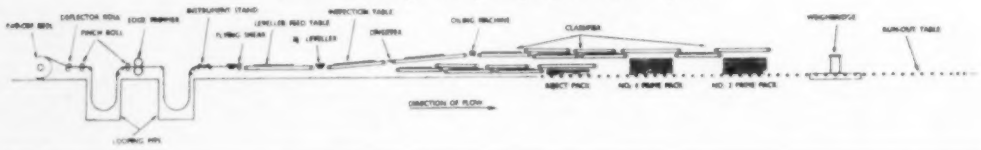
THE Head Wrightson Machine Co. Ltd., of Middlesbrough, a subsidiary of Head Wrightson and Co. Ltd., have recently been awarded orders by Messrs. Richard Thomas and Baldwins Ltd. for the supply of five steel strip cut-up lines for their new Spencer Works. These lines, which will include a number of new features, are expected to be in full production by October, 1961.

More recently Colville's Ltd. placed an order with the company for the supply of two steel strip lines to deal with hot-rolled material, one up to $\frac{9}{16}$ in. thick and the other up to $\frac{3}{8}$ in. thick and generally similar to those which are to be supplied to Richard Thomas and Baldwins Ltd. The value of these new steel industry orders for Head Wrightson is about £2½ million.

Two of the lines for the Spencer Works will be designed to handle hot-rolled material, one for thicknesses of up to $\frac{9}{16}$ in. and one for handling material up to $\frac{3}{8}$ in. thick. Both of these lines are designed to operate at speeds of up to 300 ft. per min. and to handle coils weighing up to 30,000 lb. The three remaining lines are designed to handle cold rolled strip. Two of these will be handling material in coils of up to 60,000 lb. weight and 0.105 in. maximum thickness and will operate at a higher speed than any similar line at present installed in the U.K. The third line for the handling of cold rolled material is designed to deal with very thin steel strip.

On each of the lines for Richard Thomas and Baldwins, coils of steel strip of up to 60 in. wide will be transferred from an entry conveyor to an uncoiler from which the material will be passed through an edge trimming unit and then through flying shears which cut the strip into sheet lengths while the material is moving at any speed between the minimum and maximum specified for each line. The sheets then pass through levelling machines prior to visual inspection for possible surface defects. Flying micrometers for the measuring of the strip thickness will be mounted in the lines before the flying shears, and automatic means provided for the rejection of sheets which are not of the required thickness. Beyond the visual inspection point will be two automatic pilers, one for the reception of sheets rejected because of deviation from standard thickness or surface defects and the other for the reception of prime sheets. The pilers for the prime sheets will be equipped with raising and lowering tables to enable packs of up to 20 tons of sheets to be accumulated. Motorized side guides and backstops will enable sheets of varying widths and lengths to be piled neatly. The finished packs of sheets will be discharged from the reject and prime pilers endwise on motorized roller tables to a weighing section and then on to a runout section to await transfer to the despatch department.

Schematic arrangement of a high-speed coil cut-up line



COAL POWER FOR FORD'S NEW DAGENHAM BOILER

THE fact that coal as a source of fuel and power is not a back number, is indicated in the £1¼ million order which has been secured by Babcock and Wilcox Ltd. for a coal-fired boiler for installation in Ford's Dagenham factory. The Ford decision was arrived at after careful investigation in which even atomic energy was considered before deciding that coal was the cheapest available fuel. This will provide a market for Durham coal of 600,000 tons a year, to be brought by sea and delivered direct to the Ford Motor Co's. wharf at Dagenham.

INTERNATIONAL METALLIC CORROSION CONGRESS

THE executive committee of the First International Congress on Metallic Corrosion have appointed the following plenary lecturers: Professor Y. M. Kolotyrkin of the U.S.S.R., Professor P. Lacombe of France and Professor H. H. Uhlig of the U.S.A. and Dr. U. R. Evans of the U.K. who hopes, circumstances permitting, to be the fourth. The response to invitations to submit papers to the Congress has been excellent and contributions are assured from many eminent authorities of world-wide repute. So far, papers have been accepted from 17 countries.

VENESTA FOILS LTD. have changed the address of their head office to Thorn House, Upper St. Martin's Lane, W.C.2; their new telephone number is Temple Bar 4399.

SITE SHOT-BLASTING

R. J. RICHARDSON AND SONS LTD., Commercial Street, Birmingham 1, have recently formed a new division to be known as Site Shotblasting (Great Britain) Ltd. whose task is to carry out shot-blasting on site of work too large to be catered for by transport into the works of the parent concern. The activity of the concern will cover a wide range such as the cleaning of large-bore pipes, oil tanks, gasometers, bridges, steel chimneys and large fabrications including the exterior and interior of ships, hulls and the interior of the tanks of oil tankers.

TOOL AND DIE STEELS

ATLAS STEELS (ENGLAND) Ltd. of Skimpot Industrial Estate, Luton, who distribute the special steel products of their Canadian parent company, announce that they are now carrying stocks of tool and die steels in addition to high-speed steel.

JAMES BOOTH AWARD £500,000 ELECTRICAL CONTRACT

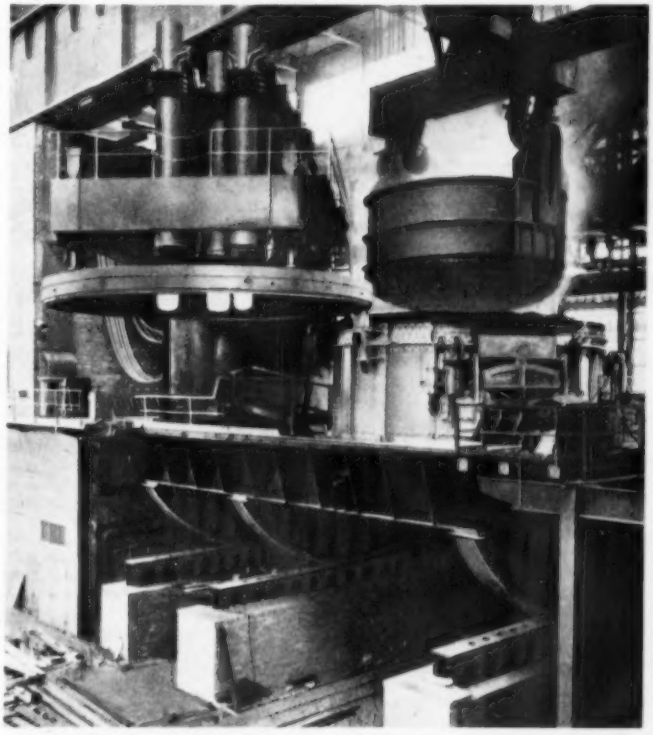
A £500,000 CONTRACT has been awarded by James Booth Aluminium Ltd. of Birmingham to the English Electric Co. Ltd. for the electrical equipment for a new 148-in. four-high hot aluminium rolling mill—the largest of its kind in Western Europe, and a new 72-in. four-high cold strip mill. The new mills, designed and supplied by The Loewy Engineering Co. Ltd., Bournemouth, are part of James Booth's £5 million expansion scheme and are to be installed in the company's Kitts Green Works, Birmingham during 1961. The motors, converting equipment, control gear and switchgear, will be manufactured at the English Electric works in Stafford, Kidsgrove (North Staffs), Liverpool and Bradford, and such auxiliaries as lubricating and ventilating equipment will be engineered by the company's Metal Industries Division (Stafford). The first of the two 180-ton housings for the new aluminium rolling mill have been cast by English Steel Castings Corporation Ltd. at their Grimesthorpe steel foundry, Sheffield, in the record time of eight weeks after the order was placed. The finished casting measures 35 ft. 9 in. high, 15 ft. wide and up to 8 ft. 7 in. thick and will be transported in August to the English Electric Co. Ltd., Netherton, Liverpool, for machining before being delivered and installed. The pattern makers, G. Perry and Sons Ltd. (Aylestone, Leicester), made the pattern for the casting, the largest they have produced, in six weeks.

Press Manufacturers hold Social Evening

COINCIDENT with the International Machine Tool Exhibition, a cocktail party was recently held by Wilkins and Mitchell Ltd. of Darlaston at Grosvenor House, Park Lane, London, for their many friends in industry, at which the opportunity was taken to show the company's new film "The Power of the Press." Details are given in the film of the construction of W. and M. presses, together with typical shots of a wide range of machines in use in various works throughout the country.

G.W.B. FURNACES LTD. TO BUILD BRITAIN'S LARGEST ELECTRIC-ARC FURNACES

FOLLOWING the announcement in the March issue that The United Steel Companies Ltd. are to spend £10 million on new electric-arc furnaces at Templeborough, G.W.B. Furnaces Ltd. have drawn attention to the fact that they are to build the first two electric furnaces for this project. These furnaces will be almost twice as large as any previously built in this country and their electrical demand will be equivalent to that of the town of Huddersfield, each furnace having an electric rating of 40,000 kVA. The furnaces will be of Demag design although apart from the regulator, which is unobtainable in this country, the units will be entirely of British manufacture, the steel construction being carried out by Distington Engineering Co. Ltd. Each furnace shell will have an internal diameter of 24 ft. and a nominal capacity of 150 tons although, in practice, they will be used for a maximum of 110 tons ingot weight. The photograph given below illustrates the type of furnace to be installed with the roof swung to one side in preparation for charging.



RUSSIA ORDERS BRITISH MACHINES

DOWDING AND DOLL LTD. 346, Kensington High Street, London, W.14, announce a further large order from the U.S.S.R. The latest order, which is valued at over £50,000, is for 26 "Dowding Universal Hobbers" complete with all necessary equipment. Of the 26 machines six are to be model V.8's for the more accurate gears up to 8 in. dia., 7 in. face width, the remaining 20 being V.4's for the smaller gears up to 4 in. dia., 4 in. face width.

TOOLS FOR YACHTSMEN

THE four British yachtsmen who started a race across the Atlantic recently, Col. Haslar, Francis Chichester, Dr. David H. Howells and Valentine Howells, were each presented with a comprehensive kit of tools, including screwdrivers, hammers, drills, lightweight portable vice and an axe, by Stanley Works (G.B.) Ltd. of Rutland Road, Sheffield, the makers of Stanley tools, to deal with emergencies which might occur in the 3,000 miles of ocean crossing.

NEW COMPANIES

"Ltd." is understood, also "Private Co." Figures — Capital, Names — Directors, all unless otherwise indicated.

J. H. MARSHALL AND SONS, Stadium Works, Sedgley Street, Wolverhampton. May 17. £3,000. *To carry on bus. of sheet metal workers. James H. Marshall.*

PRESSED DEVELOPMENTS AND MANUFACTURING, 109, Colmore Row, Birmingham, 3. May 10. £1,000. *To carry on bus. of sheet metal pressing manfrs., etc. Kenneth J. Sanders and Nancy L. Sanders.*

CAMBRIDGE SHEET METAL AND ENGINEERING, Low Mill Print Works, Town Lane, Whittle-le-Woods, nr. Chorley, Lancs. May 23. £2,000. *To take over bus. carried on as "Cambridge Sheet Metal Company." Thomas S. Allen, Corrigan W. Ford, Leslie Miller and Raymond Weir.*

H. V. HARMAN. May 23. £10,000. *To carry on bus. of sheet metal workers, etc. Directors to be appointed. Subscribers: Herbert V. Harman, Tally Hoe, Pittville, Circus Road, Cheltenham, Harry Grundy, 25, Goldieslie Road, Sutton Coldfield.*

REDFERN AND BIRCHALL, East Street Works, Bury, Lancs. May 13. £2,000. *To carry on bus. of welders, sheet metal workers, etc. Arnold Rigby, Derek Lowcock.*

E.F.B. METAL PRODUCTS, Lake Farm, Botwell Lane, Hayes, Middlesex. May 11. £5,000. *To take over the bus. of sheet metal workers carried on by Ernest H. Wiffin, Francis E. Way and Brian Mills.*

WILSON HART METAL STAMPINGS. May 24. £10,000. *To carry on bus. of engineers, etc. Directors not named. Subscribers: David J. Hart and Raymond M. Hart, 33, Knightsbridge Court, S.W.1.*

A. WARD AND CO. (FABRICATIONS), The Forge, Walsall Street, Wolverhampton. May 27. £5,000. *To acquire that part of the bus. formerly carried on by A. Ward (Wolverhampton) relating to welding, sheet metal work and dealers and workers in metals, plastics, etc. Arthur Ward, Norman T. Gallant, Henry N. Rust.*

FURNESS AND JONES, Church Buildings, Bartlemore Street, Oldham. May 31. £1,000. *To take over bus. of a sheet metal worker and engineer carried on as Furness and Jones. Kenneth Furness and Alma Furness.*

From the Register compiled by Jordan & Sons Ltd. 16, Chancery Lane, London, W.C.2.

Books for Your Library

Vacuum Processing in Metal-working, by J. Wesley Cable, 1960. Reinhold Publishing Corporation, New York. Chapman and Hall, 37, Essex Street, London, W.C.2. 202 pp. Price 44s.

THIS book presents, in an easily read style, the essential features of vacuum equipment, used in a range of metallurgical processes, *e.g.*, melting, heat-treatment, sintering and brazing. Brief but adequate descriptions of electron beam melting and welding techniques justify the subject matter as being regarded as reasonably up to date.

Descriptions of the essential features to be considered in the choice of design of vacuum chambers, pumping equipment and heating equipment in each specific field, reflect the author's special competence. On the other hand, the reader who hopes to be informed on the fundamental metallurgical virtues of particular processes will find only very general guidance in some places, and mis-guidance in others. Thus, on the penultimate page he is told that "precipitation and solution hardening of such materials as Inconel, K Monel, Ni-span C and nickel-chromium-titanium alloys, have been improved by performing the prescribed heating cycle in a vacuum." Some obscure mystery seems to be implied but a metallurgist would see no essential benefit other than preventing the alloy from oxidizing; the first-named alloy is not generally regarded as being age-hardenable.

An aim to present the subject in the descriptive rather than a highly technical form is admirably successful. The author advises the reading of published technical literature for those desiring to enquire more deeply; hence the lack of a selected bibliography, other than a footnote referring to a text by the same author on induction and dielectric heating, is perhaps unfortunate.

It is not clear for whose benefit this book has been produced. Those already engaged in designing, building or using such vacuum equipment, would be helped but little; it could, however, be reasonably recommended if published at a popular price to those who have little or no theoretical training, but wish to be informed of what is happening in an increasingly important field.

A. W. FRANKLIN.

Practical Design of Sheet Metal, by Frederico Strasser, published by Chilton Co., Book Division, 56th and Chestnut Streets, Philadelphia 39, Pa., U.S.A. 134 pp. $10.

IN this book, the author shows the factors in the design of metal stampings which bring about economical and trouble-free production and how this kind of production may be achieved by an intelligent application of the basic rules and concepts of stamping techniques.

Basic concepts, details of design and special problems form the basis of this study of the processes that transform sheet-metal sheets or metal slugs into the final products or product components.

This book will be valuable to anyone engaged in or interested in the production of articles made of die-produced components; it will be a reference for practical mechanical designers, draughtsmen and engineering students. Strasser, himself, has been a mechanical designer for many years and has spent some 30 years as tool engineer and component designer in Milan, Cologne, and Santiago, Chile.

Change of Address

UDDEHOLM LTD. have drawn attention to the fact that the proposed removal of their London office to 124, Victoria Street, S.W.1, announced in the June issue, did not in fact materialize, but other premises were obtained at 78, Buckingham Gate, London, S.W.1, telephone SULlivan 2741.

Forthcoming Events . . .

September 7

Institution of Plant Engineers (Leicester Branch). Film and discussion "On Schedule" by F. W. L. Heathcote (J. Brockhouse and Co. Ltd.), at the Saracen's Head Hotel, Leicester. 7 p.m.

September 27

Institution of Plant Engineers (South Wales Branch). "Electric Welding Applications for Plant Maintenance and General Fabrication" by C. V. Lewis, A.M.Inst.W. (Murex Welding Processes Ltd.), at the South Wales Engineers' Institute, Park Place, Cardiff. 7.30 p.m.

September 30

Institution of Plant Engineers (Birmingham Branch). "Metal Stitching" by N. Tinwell, Chief Engineer (Metalock (Britain) Ltd.) at the Imperial Hotel, Temple Street, Birmingham. 7.30 p.m.

Institute of Metals Autumn Meeting

THE Autumn Meeting of the Institute of Metals is to be held in Bath from September 5 to 9. The reception committee under the chairmanship of Mr. D. M. G. Sneddon, general manager of the Imperial Smelting Corporation Ltd. of Avonmouth has arranged a programme which includes visits to local places of interest and works and also scientific discussions on papers which have been published in the journal. The discusson programme is to be divided into two sections to be run simultaneously; the themes for programmes "A" are "Engineering Properties of Nickel-Base Alloys", September 5; "Recovery and Recrystallization", September 6; "The Relative Merits of Extrusion and Other Methods for the Manufacture of Bar, Rod and Wire-Rod", September 8; those for programme "B" are "Lubricants for Cold Rolling Aluminium", September 5; "Properties of Metals", September 6; "Magnesium Alloys for Fuel-Element Components" September 8. The last day, September 9 will include the Autumn Lecture on "Metals and the World of Engineering Structures" by Professor Sir Alfred Pugsley, of the University of Bristol.

JOINT SUMMER MEETING ON NON-DESTRUCTIVE TESTING SEPTEMBER 22-24, 1960

A CONFERENCE on the "Theory and practice of ultrasonic inspection" is to be held at the Queens Hotel, Cheltenham, during the period September 22 to 24, 1960. The arrangements are being made jointly by The Institute of Physics' Non-Destructive Testing Group, The Society of Non-Destructive Examination and The Non-Destructive Testing Society of Great Britain.

Further details of the programme, and of hotel accommodation in Cheltenham, can be obtained from the conference secretary, Mr. I. M. Barnes, Materials Laboratory, de Havilland Propellers Ltd., Hatfield, Herts.

3-Year Course in Applied Chemistry Specializing in Metal Finishing

A THREE-YEAR sandwich course for the Higher National Diploma in Applied Chemistry with Specialization in Metal Finishing is being arranged at the Borough Polytechnic, Borough Road, London S.E.1, commencing September 22, 1960, and will be the first and only one of its kind to be held in the United Kingdom with the prime object of giving students a sound scientific background prior to embarking on a detailed study of metal finishing and corrosion science. The minimum qualification for admission is either an Ordinary National Certificate in Chemistry or a General Certificate of Education (Advanced Level) in Chemistry, or satisfactory completion of another comparable public examination. The types of students admissible will be those who are supported independently, those who have scholarships from Local Education Authorities and those who are trainees of firms in different parts of the United Kingdom. The normal fee for students resident in the Administrative County of London is £17 per session and an additional membership fee of £1 1s. per session. Students residing outside the County of London may qualify for enrolment at the same fee as those resident in London on application to their Local Educational Authority. Applications from the London area should be made to the secretary and clerk to the Governing Body, Fredk. J. Packer, F.C.I.S., A.M.B.I.M., Division of Metal Science, Borough Polytechnic.

SHORT COURSES IN METAL SCIENCE

THE Borough Polytechnic are arranging a series of special evening courses in the Division of Metal Science during the winter term 1960/61. A course on "Corrosion and Protection of Metals" will be held on one afternoon and one evening a week throughout the session (*i.e.* three terms) commencing on Monday, September 26, 1960, and will deal with "Chemical and Electrochemical Principles", "Metallurgy", and "Corrosion and Protection of Metals". A course of six meetings, commencing Thursday, October 6 from 7 to 9 p.m., on "Recent Developments in Electrolytic Metal Finishing" will deal with recent developments in nickel, chromium and precious metals, and in anodizing of aluminium and aluminium alloys. A second evening course of ten meetings "Refractories, Their Manufacture, Properties and Uses" will commence on Friday, October 7, from 7 to 9 p.m. Another course, "Metallurgy of Semi-Conductors", will commence on Tuesday, October 25, also from 7 to 9 p.m. Applications should be made to the Senior Lecturer, Division of Metal Science, Borough Polytechnic, Borough Road, London, S.E.1.

American Welding Society

THE American Welding Society Fall Meeting will be held in the Penn-Sheraton Hotel, Pittsburgh, Pa., September 26 to 29, 1960. Seventeen sessions will be held and a total of 51 technical papers will be presented. AWS Headquarters are at 33 West 39th Street, New York 18, N.Y.

SCHOOL OF WELDING TECHNOLOGY

THE Institute of Welding have announced that the following courses will be held at the School of Welding Technology in September and October :—

Course D.1/3, September 26-30, 1960. Welded Pressure Vessels—for Designers.

Course D. 13/2, October 10-11, 1960, Residual Stresses and Stress Relief—for Engineers and Metallurgists.

Course D. 12/2, October 12-14, 1960, Practical Control of Distortion—for Works Engineers and Supervisory Staff.

Course D. 18/1, October 24-27, 1960, Metal Spraying.

Publications for Industry

Leicester, Lovell and Co. Ltd. have produced a revised edition of their catalogue of products—"A Guide to Resins and Glues for industry." The catalogue is intended as a general guide to the company's range of synthetic resins (ureas, phenolics, resorcinols, epoxides, furanes), casein, P.V.A. and animal glues and a variety of other types of adhesives. The catalogue has been compiled with the reader's interests particularly in mind—reference headings, for example, are based on the applications of the products rather than the products themselves. A comprehensive index covers both the applications and the industries to which they are applicable. These industries include boat building, building, electrical, engineering, foundry, furniture, packaging, plastics, plywood and tooling.

Copies of the catalogue are available from the company at North Baddesley, Southampton.

* * *

The eighth issue of a unique industrial annual "Foreman" has been published by the Industrial Welfare Society 48, Bryanston Square, London, W.C.1., price 2s. 6d. It provides a wide range of knowledgeable contributions from authoritative writers on a variety of topics of interest to the foreman and the supervisor.

One of the most difficult decisions which management of any kind has to make is the selection of personnel in whom it can invest authority over other people. A leading article by John Cronin evaluates the qualities of leadership necessary in a supervisor.

* * *

A new edition of the handbook "Welding, Brazing and Soldering of Wiggin High-Nickel Alloys" has been recently published by Henry Wiggin and Co. Ltd. This publication, which is illustrated with photomicrographs of welds and many tables, provides general information on the welding, brazing and soldering of the company's products. The contents include chapters on oxy-acetylene welding, metal-arc welding, inert-gas shielded-arc processes, atomic-hydrogen welding and flash-butt welding, as well as sections on the lining of vessels and on the welding of dissimilar metals.

Another publication, which is compiled mainly of photographs, some of which are in colour, "An Introduction to Wiggin Nickel-Alloys," illustrates the technical applications of high-nickel alloys which are divided into four categories, corrosion-resistant, heat-resistant, electrical-resistance and materials with special properties. The first part of the publication is devoted to these properties of the alloys and explains how they are assessed; the latter part illustrates some actual applications of high-nickel alloys.

Both publications are obtainable free on request from Henry Wiggin and Co. Ltd., Publicity Department, Thames House, Millbank, London, S.W.1.

* * *

The *Copper and Brass Bulletin*, issued by the Copper and Brass Research Association, 420 Lexington Avenue, New York 17, is a quarterly publication giving interesting information on copper and copper-base alloy mill products and their use in American industry. A recent issue makes an annual review of the use of copper metals in the various fields of building construction. The views of contractors and manufacturers express the reasons, both for economy and convenience, to justify the employment of these materials for plumbing lines, window frames, flashings, roofs, heating, snow-melting and even flag-poles. The May issue is largely devoted to the use of copper in the marine field.

* * *

C. & P. Development Co. (London) Ltd., manufacturers of Rust-Anode zinc-rich paint, issue a leaflet on their "Skaline" mill scale remover. The purpose of Skaline is to prepare surfaces prior to the application of protective coatings. It makes a most useful pre-treatment of metal before applying Rust-Anode particularly where mill scale is prevalent, and when sand blasting is impracticable, or impossible on standing structures and equipment.

* * *

John Summers and Sons Ltd. have just published the first edition of their new "John Summers Review." Issued quarterly, this four-page publication with colour front and back pages, will regularly provide metal manufacturers, industrial designers, architects and other technicians with up-to-date details of applications of sheet steel, particularly John Summers' plastic-coated steel, Stelvetite. Copies of the "John Summers Review," are being distributed to interested concerns in Britain and overseas. Further copies may be obtained direct from John Summers and Sons Ltd., Hawarden Bridge Steelworks, Shotton, Chester.

* * *

"Capital for Industry and Trade" is the title of a new leaflet produced by The Charterhouse Group Ltd., 30 St. Swithin's Lane, London, E.C.4 which outlines the services provided by member companies. Services thus briefly described include the provision of permanent and semi-permanent capital, sponsoring public issues, offers for sale and placings. Other activities of the group described in the leaflet include merchant banking facilities, hire-purchase finance, and insurance of trade credits.

* * *

The painting of shot-blasted steel, specialized protective treatment for aluminium and galvanized iron, and time-tested anti-corrosive protectives and finishes are among the subjects comprehensively covered in *A Manual of Marine Paints*, published by John S. Craig and Co., Ltd.

The manual first analyses in detail the requirements for protective and decorative finishes on metals in specialized conditions, and then provides recommendations to meet the individual requirements of users. Although produced primarily for the shipbuilding and marine trades, the manual, both in its general scope and detail of subjects covered, is of direct interest to the heavy steel and metal industries. Copies of the manual may be had upon request from John S. Craig and Co., Ltd., 12-40, Bogmoor Road, Glasgow, S.W.1.

* * *

"The Bonderizer," published by the Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford, Middlesex, contains an interesting article on the use of steel partitioning for office construction as supplied by the Norwood Steel Equipment Ltd. The Pyrene Co.'s "Sales Information Bulletin" No. 3 introduces "Pyroclean" No. 9—a heavy-duty alkali-type cleaner supplied in powder form and used in aqueous solution normally within a temperature range of 190 to 205° F. for cleaning iron and steel; it can also be used in still tanks, automatic plants combining dip and spray, spray cleaning machines and in the cleaning sections of automatic metal pre-treatment plants.

The National Coal Board, Hobart House, Grosvenor Place, London, S.W.1, have issued a booklet, "The Case for Coal," designed to appeal to industrial and commercial users who between them consume 50 million tons of coal a year. The booklet sets out to prove that Britain's indigenous fuel can be the economical answer to most industrial fuel needs and devotes a page each to industrialists, architects and consulting engineers, and to local authorities, reminding them of the most effective methods of using coal in their own particular fields; another page explains how the Clean Air Act works. The second part of the booklet is devoted to a short but clear appraisal of the four types of mechanical stoker most commonly in use and gives guidance as to their range and suitability.

* * *

Precision Components (Barnet) Ltd., Kabi Works, Cranbourne Road, Potters Bar, Middlesex, makers of polythene bowls, buckets, bins, etc. have issued an illustrated leaflet giving prices and descriptions of the range of articles produced by them.

* * *

The British Electrical and Allied Industries Research Association have recently published a report, ref. Z/T118, "Joints in Aluminium and Aluminium Alloy Busbars—Experiments on Contact Resistance," by A. P. Singh. The experiments referred to consist of an examination in the variation in contact resistance with contact pressure for aluminium and aluminium alloy busbars, using various surface preparations. The effect of temperature on joint resistance is also dealt with using an examination of copper busbar joints as a standard reference for the aluminium bars which consist mainly of rolled aluminium bars since it is found they give a lower joint resistance than extruded bars.

* * *

British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1, have issued a pamphlet "Epok Water Soluble Stoving Primer Resin," describing a water soluble resin they have developed for industrial stoving primers which compares very favourably with conventional primer vehicles in performance but has many advantages over the latter by reason of non-flammability, the absence of toxic vapours, easier pigment dispersion and its ability to be thinned by water.

Measures for the protection of workers against the inhalation of dusts or fumes or other impurities likely to be injurious are discussed in a new booklet "Toxic Substances in Factory Atmospheres," published by the Ministry of Labour.

This booklet is the latest in a series designed to give information and advice about questions of safety, health and welfare in industry.

Some hazards and the proper precautions against them are well known, but with the increasing complexity of industrial processes new substances are coming into use. The first step in all cases is to know what substances are being used, and the possible hazards involved.

"It is of prime importance," the booklet states, "always to be on the look out for a possible hazard, and, to bear in mind the possible need for precautions." A toxic substance should wherever possible be substituted by a harmless one or, failing this, a less harmful substance. Where a toxic substance must be used, and substitution is impossible or only partially possible, the best protection lies in the total enclosure of the process or plant, or failing this, the use of the "fume cupboard" principle familiar in chemical laboratories. "Built in" safety precautions are always preferable to personal protective equipment, but in cases in which toxic dusts or fumes cannot be adequately controlled by any of the methods discussed in the booklet, appropriate respirators or breathing apparatus should be provided and worn. The need to wear protective clothing, and for thorough washing of exposed parts of the body are emphasized as means of protection against toxic materials which can be absorbed through the skin.

The booklet gives figures of maximum permissible concentrations of certain substances used in industry as a guide to which the efficiency of control measures should be related. These figures are subject to revision in the light of increasing scientific knowledge.

Amendments to the list will be published from time to time and arrangements have been made to send them on request to those who return a postcard in the booklet indicating their desire to have the alterations.

* * *

An illustrated handbook (Bulletin 23) has just been published by British MonoRail Ltd., describing the overhead materials handling system, and ways in which the system is applied to cater for different industrial handling requirements.

The booklet describes the standard precision parts comprising the "British MonoRail" system, which can be used to provide minimum-headroom underslung cranes with capacities of up to five tons, and, because the crane rails can be supported from the roof, of virtually unlimited span.

Copies of the booklet are available from British MonoRail Ltd., Wakefield Road, Brighouse, Yorkshire.

* * *

The 3rd edition of Publication No. 37 is the first descriptive, fully illustrated 48-page catalogue issued by Keith Blackman Ltd. to describe their range of Type AR, aerofoil section backward-bladed centrifugal fans. The first and second editions were in leaflet and folder form.

This new, two-colour edition provides full details concerning the design of impellers, casings, drive arrangements, bearings, maintenance, etc. plus extensive capacity tables ranging from 1,000 to 50,000 cu. ft. per min. with pressures from 1.0 to 15.0 in. w.g. Dimension tables and drawings are also included. This efficient and relatively quiet operating fan is designed for forced and induced draught boiler installations, for air conditioning, ventilation of buildings and mines and general industrial use.

* * *

The Dudley Court Machine Co. Ltd. of 2a, Parkhurst Road, London, N.7, have produced a booklet entitled "DCMC Industrial Aerosols" giving full details and specifications of the comprehensive range of aerosol packed industrial products including colour coding paints, silicone mould release, rust inhibitor, all-purpose solvent, degreasing fluid, etc.

* * *

"Hydraulic Oils" is the title of a 74-page handbook just published by Wakefield-Dick Industrial Oils Ltd., a member of the Castrol group of companies.

This book, which contains 50 illustrations, will be a most useful addition to the bookshelf of any engineer concerned with the design, installation, operation or maintenance of hydraulic equipment. Students, too, should find the many graphs and formulae extremely helpful.

"Hydraulic Oils" includes chapters on fundamental hydraulic principles, hydraulic systems, pumps and components, and hydraulic fluids; copies are available to readers of this journal, free on request to Wakefield-Dick Industrial Oils Ltd., Castrol House, Marylebone Road, London, N.W.1.

ASTM—SIXTY-THIRD ANNUAL MEETING

THE American Society for Testing Materials held its 63rd annual meeting at the Chalfonte-Haddon Hall, Atlantic City, June 26 to July 1, 1960. The society's new Division of Materials Sciences, as its first activity, arranged a full-day programme on the opening day, starting with a "Symposium on Recent Progress in Materials Sciences" consisting of four papers—"Accomplishment and Limitations of Solid State Theory," by Harvey Brooks (Harvard University); "The Influence of Surfaces on the Properties of Materials," by M. J. Sinnott (University of Michigan); "Mechanical Properties of Semiconductors," by J. N. Hobstetter (University of Pennsylvania); "Status of Ductile Ceramic Research," by E. R. Parker (University of California). The afternoon session contrasted with a "Symposium on Nature and Origin of Strength of Materials" including five papers—"Dislocation Motions and the Yield Strengths of Solids," by J. J. Gilman (General Electric Co.); "Fatigue Strength of Solids," by G. M. Sinclair (University of Illinois); "Resistance to Creep Deformation and Fracture in Metals Alloys," by Frank Garofalo (U.S. Steel Corporation); "Brittle Fracture and the Strength of Metals," by E. T. Wessel (Westinghouse Electric Corporation); and "Size and Shape Effects on Fracture of Solids," by George Irwin (Naval Research Laboratories).

Dr. R. Carson Dalzell presented the 8th Gillett Memorial Lecture, and chose as his subject the problems of standardization of fuel elements facing the designers of nuclear reactors. This lecture, jointly sponsored by the A.S.T.M. and Battelle Memorial Institute, commemorates Horace W. Gillett, first director of Battelle and one of the country's leading metallurgists, and each year covers a subject pertaining to the development, testing, evaluation and application of metals.

Dr. Farrington Daniels, vice-president of the National Academy of Science and professor emeritus of the University of Wisconsin, presented the annual Edgar Marburg Lecture, which is a memorial to the first secretary of ASTM and was established to emphasize the importance of furthering the knowledge of properties and testing of engineering materials. Dr. Daniels discussed the abundance and limitations of solar energy and reviewed solar energy research.

The annual meeting covered 35 to 40 technical and report sessions and meetings of eight to nine hundred technical committees and their sub-committees.

ARALDITE AND GLASSCLOTH MODEL CAR

THE photograph shows a quarter-size scale model of an Austin A55 Mark 2 Saloon Car made from Araldite epoxy resin and glasscloth.

The model, made by the Austin Motor Co. Ltd., is used to check the general appearance, style and colour scheme of the car before starting production. Several models of this type are made for each new design of car.



GRIFFIN AND GEORGE ACQUIRE R. AND J. BECK

GRIFFIN AND GEORGE, LTD., Ealing Road, Alperton, Middlesex, have purchased the whole share capital of R. and J. Beck, Ltd., one of the oldest-established firms of optical instrument manufacturers in Britain, having two works, at Watford and Kentish Town, and offices and a showroom at Mortimer Street, London, W.1. The total staff employed is over 200.

It is the intention of Griffin and George, Ltd., to retain the individuality of Beck's as a separate entity, but, at the same time, it is anticipated that the growth and future prosperity of that company will benefit from an association with the larger organization. Griffin and George, Ltd., have undertaken the continued employment and future treatment of existing staff and the name of the business will remain unchanged.

The present Board, consisting of Messrs. C. J. Beck, S. Borthwick, G. E. Fowler and H. W. Morgan, will remain in office and be joined, in due course, by Messrs. M. Lyth, H. C. Mayer, R. C. Palmer and F. A. Renn as additional directors representing Griffin and George, Ltd.

R. and J. Beck, Ltd., manufactured the new 3-D image microscope, designed by a team led by Mr. Richard Gregory, at the Cambridge University Psychological Laboratory. The microscope is proving useful in the examination of living cells and thick sections of suitably strained brain tissue to see how the brain cells are related to each other.

CRANE CONTROLS CONTRACT FOR SPENCER WORKS

BROOKHIRST IGRANIC, a company in the Metal Industries Group, is to supply crane controls valued at £120,000 to the new Spencer works of Richard Thomas and Baldwins at Llanwern, near Newport, Monmouthshire. This brings to more than £400,000 the value of crane controls ordered from Brookhirst Igranic since the beginning of this year.

HYDRAULIC PRESS BRAKE

In our July issue, page 556, reference is made to a "Bronx" 120-ton hydraulic press brake. The address of the company is the Bronx Engineering Co. Ltd., Lye, Near Stourbridge.

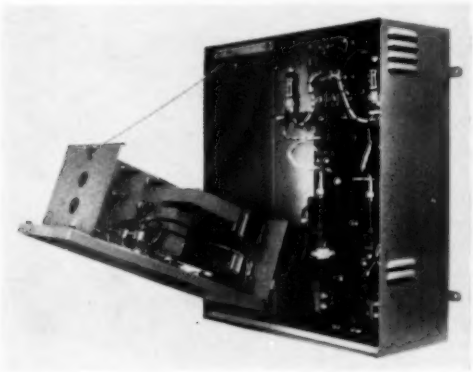
New Plant and Equipment

Electronic Control Equipment for Welding

THE equipment illustrated in Fig. 1 is the latest addition to the British Federal Welder and Machine Co.'s range of electronic control equipment, which is a fully synchronous control, applicable to either seam- or spot-welding machines and embodying ignitron phase shift heat control features together with fully synchronous timing controls.

The timing unit is carried on a pivoted chassis which can be readily removed for inspection or maintenance purposes and the hinged section allows it to be lowered to provide means of inspecting the circuit while the control is operative. The unit, which is of compact size, is designed for wall mounting and will accept either "B" or "C" size ignitron tubes. Further details are available from British Federal Welder and Machine Co. Ltd., Castle Mill Works, Dudley, Worcestershire.

Fig. 1.—Electronic control equipment



Multi-Stage Non-Synchronous Timer

LANCASHIRE Dynamo Electronic Products Ltd., Rugeley, Staffs., announce that a number of new models of multi-stage non-synchronous timing equipment has now been added to their extensive range of resistance-welding control equipment. The two units have been designed to provide a compact assembly suitable for building into resistance-welding machines and incorporate switching arrangements for air valves and electro-magnetic or ignitron contactors.

Three basic units are in production for stock for two, three or four stages of time control. Typical control sequences are "Weld-Forge," "Weld-Hold-Off" and "Squeeze-Weld-Hold-Off" all with facilities for single or repetitive spot operation.

The four-stage unit is particularly suitable in view of the increasing use of pressure before weld sequences and enables the conventional pressure switch to be omitted if this is considered to be desirable. A very high rate of repetitive spot welding has been achieved with this timer and welding rates of 180 spots per min. have been achieved with perfectly reliable results.

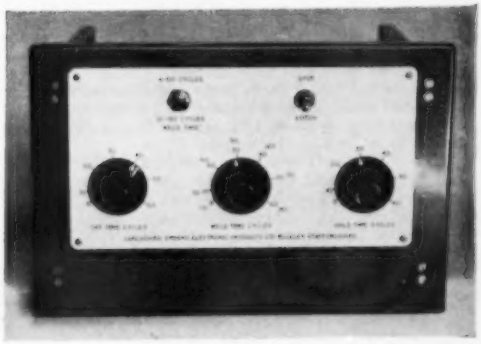


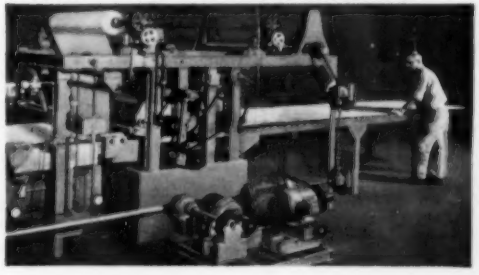
Fig. 2.—Multi-stage non-synchronous timer

Laminating Machine

A NEW laminating machine, the "Contropress" Fig. 3, said to reduce the price of hard surfaced decorative wall, ceiling and roof boards by one-third to one-half of current U.K. prices, is now being manufactured by Mather and Platt Ltd., Manchester, 10, under licence from C. A. Litzler Co. Inc., Cleveland, Ohio. The machine applies polyester and vinyl films continuously without resorting to the use of static presses; films pre-printed with veneer or other effects can be applied to plywood, blockboard, chipboard, asbestos board, hard-board and fibre-board for indoor or outdoor use. Shuttering boards for use on concrete structures, skin panels for foam laminates and cigarette-proof boards can also be produced by laminating foils or vinyl films to cheap boards.

Sheet metal can be laminated with film equally well after the appropriate cleansing and etching procedures have been carried out and recent research carried out at the United States Litzler laboratories indicate that the Contropress is capable of producing "rigidized metal" by laminating thin aluminium, copper or stainless steel to plywood.

Fig. 3.—Laminating machine



Welding Tools

TWO new tools for the welding industry and for maintenance shops are now offered by Interlas Ltd., of 232, Bromham Road, Bedford.

The first is the Zipweld adjustable workholder, Fig. 4, which enables two pieces of round, flat or square section material to be held at any angle for accurate welding. Two sizes of the tool are made, to accommodate 2 in. and 3 in. section material respectively, and as their weights are only 4 lb. and 10 lb., they can be comfortably handled *in situ* as well as bench work.

The second tool, Fig. 5, is the new Interlas "Terrier" electrode holder, in two sizes. The 400-amp. model accommodates $\frac{1}{16}$ in. to $\frac{1}{4}$ in. electrodes and the 600 amp. model $\frac{1}{16}$ in. to $\frac{5}{16}$ in. electrodes.

The "Terrier" is a fully insulated holder; the head has been designed with an air gap between the inner brass parts and the outer insulators to assist its cooling properties, a screw-in positive cable connection for safe working at high amperages, and a longitudinally ribbed handle for comfortable working by the operator. The hook shape of the head enables electrodes to be used down to the last inch and it is also designed so that the holder complete with cable may be hung up anywhere by the operator.

Fig. 4.—Adjustable workholder

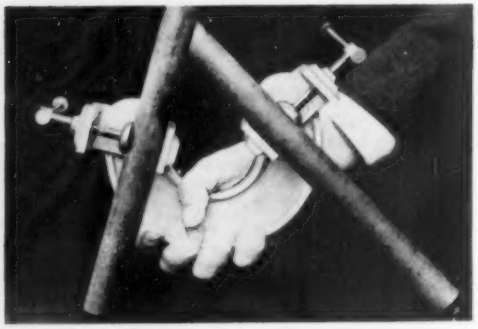
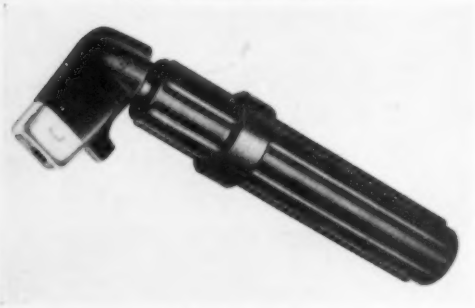


Fig. 5.—Insulated electrode holder



Pistol Drills

BLACK AND DECKER announce two new additions to their range of "Holguns" pistol drills.

The Industrial Holgun (Fig. 6) is a more powerful motor unit mounted on ball bearings and is available in two speeds specially designed for industrial and tradesmen's use. It is a light-weight drill with sufficient power for constant high-speed drilling with a housing design aimed at reducing operator fatigue. The speed range for no load is from 1,700 to 2,500 r.p.m., and it will drill up to $\frac{1}{4}$ in. in steel.

The Masonry Holgun (Fig. 7) has been designed for all drilling in masonry and ceramics and can be regarded as one of the lightest and most powerful units of its kind for this special application. A sturdy nose clamp side handle is included in the design which gives the operator complete control in high torque drilling, and will drill up to $\frac{1}{4}$ in. in masonry.

Further information may be obtained from Black and Decker Ltd., Harmondsworth, Middlesex.

Fig. 6.—Industrial pistol drill



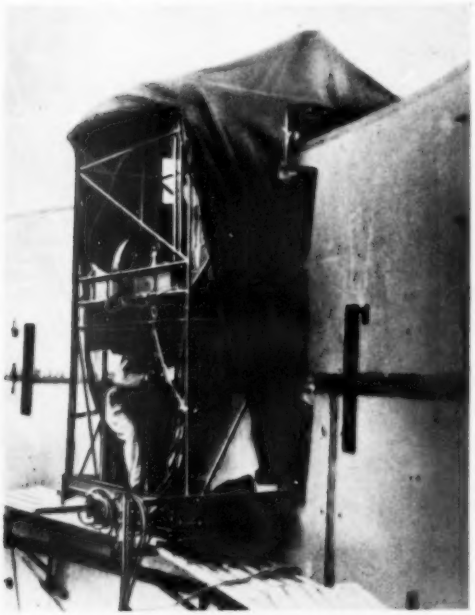
Fig. 7.—Masonry pistol drill



Automatic Seam Welder

FIG. 8 shows the automatic seam welder produced by Rockweld Ltd., Commerce Way, Croydon, Surrey, designed for field welding of horizontal girth seams in large storage tanks and claimed to provide a method of welding which is 10 times faster than normal methods. The machine consists of two enclosed platforms straddling the tank wall and hung from a top carrier which runs on two grooved wheels, swivel-mounted and driven by a motor through a remote-controlled speed variator; two speeds are available—10 to 100 in. per min. and 80 to 200 in. per min. Both platforms are fitted with pivoted adjustable motor-operated arms each carrying an automatic welding head, a slag-supporting device and a protective enclosure equipped with coloured lenses to view the visible arc. Both operators can communicate with each other through throat-microphone telephones. Welding generators giving outputs up to 750 amp. per head are required for the welding heads and the motors require a three-phase 5-kVA power source.

Fig. 8.—Automatic seam welder



Surface Treatment of Aluminium

THE Walterisation Co. Ltd. of Purley Way, Croydon, have produced surface treatments for aluminium—"Walterbryte"—providing a satin etch finish which is highly decorative in itself and offers a suitable pre-treatment for a protective chemical oxidation process. There are two treatments, Walterbryte H. (heavy) or Walterbryte B (light) which give a bright satin or silver appearance while at the same time removing extrusion or other surface defects. The H process has been primarily designed as a heavy etching treatment to remove extrusion or draw marks and the B process removes less metal and is more suitable for light etching and treatment of surfaces where it is necessary to remove the highlights from bright or polished aluminium and gives a finer and brighter finish.

Silent Pneumatic Drills

B. O. MORRIS LTD., manufacturers of polishing equipment, of Morrisflex Works, Briton Road, Coventry, have introduced in this country a range of pneumatic drills made in Holland, an example of which is shown in Fig. 9. The body is streamlined, with a pistol grip and trigger and the chuck is shrouded for additional safety; the tool is very quiet in operation. The popular model, B.12/30, is fitted with a $\frac{1}{4}$-in. chuck running at 3,000 r.p.m., and B.12/41 is similar at 4,100 r.p.m. For drilling stainless and Nimonic materials a range of slow speeds is available, B.12/4—400 r.p.m.; B.12/6—600 r.p.m.; B.12/8—800 r.p.m., B.12/10—1,000 r.p.m.

Fig. 9.—Silent pneumatic drill



Cadmium Plating Process

THE Hanson-Van Winkle-Munning Co. of Church Street, Matawan, New Jersey, have introduced a simple-to-operate low-cost process for bright cadmium plating, Cadalume L., for the protection of iron and steel parts against corrosion and non-ferrous metals subject to surface tarnish and corrosion or those which form undesirable galvanic couples in dissimilar metal assemblies. The process is claimed to have the following characteristics: increased plating speeds, improved deposit distribution and throwing power, heavier deposits without loss of brilliance or tendency to form nodules or trees, stable brighteners with no salting-out effect, no tendency to induce pitted deposits, wide bright range.

Transistorized Stroboscope

DAWE INSTRUMENTS LTD. have produced a fully transistorized stroboscope—Type 1211 Strobo-pack—claimed to be the first of its kind in the world, consisting of a portable battery-operated lightweight model for speed measurement and the study of rotating, reciprocating or vibrating machines, designed specifically for use in locations where a mains supply is not available. Power supply is derived from a 12-v. accumulator or from any 12-v. d.c. source capable of providing 1 amp. The neon-filled stroboscopic lamp is designed to give a short flash duration so that sharp images are obtained at all speeds; the range is 600 to 15,000 flashes per min. in two stages, 600 to 3,000 and 3,000 to 15,000.

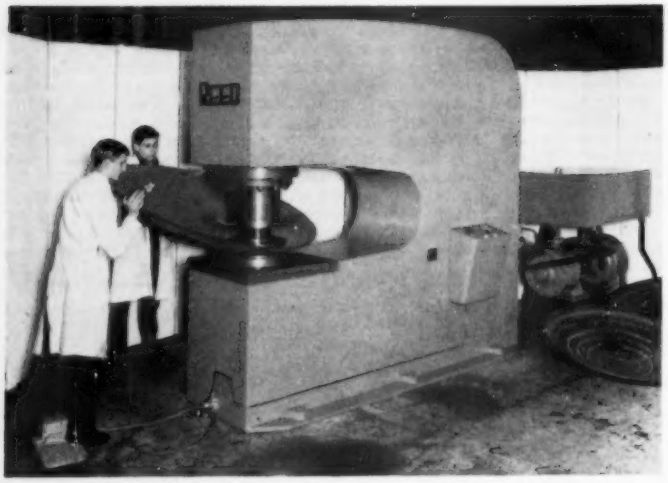


Fig. 10.—Hydraulically-operated dishing press

Hydraulic Progressive Dishing Presses

FOLLOWING the introduction by Reed Brothers (Engineering) Ltd., London, S.E.18, of a pneumatic progressive dishing press for forming thin plate dished ends, this company are now marketing similar presses of increased power and hydraulically operated, capable of forming by the progressive method, plates of much greater thickness.

The range is, therefore, increased by the introduction of 50-ton and 100-ton presses, the 50-ton unit being capable of producing high-quality dished ends in mild-steel plates up to $\frac{1}{2}$ in. thick and 8 ft. diameter, and the 100-ton unit, dished ends in plates $\frac{3}{4}$ in. thick and 8 ft. diameter, all plates being cold worked. Fig. 10 shows a large dished end being formed in the builders' works prior to the press being despatched to customer's plant. Although the presses are primarily marketed for plate dishing, they are equally suitable for performing general press and hot forging work, the latter particularly, as the press is capable of operating at speeds up to 100 strokes per minute. For flanging work pillar-type guides and crosshead can be supplied as an extra.

Hydraulic power is supplied from a self-contained pumping system operating with oil as the pressure medium, and is complete with motor starter. Control of the press is by foot pedal, and as a repeater system of control is incorporated, the press will cycle so long as the pedal is kept depressed. Adjustment of operating speed can be easily and quickly carried out over a range from 12 to 100 strokes per minute. Cyclic control is also available.

The main dimensions of the respective presses are:—

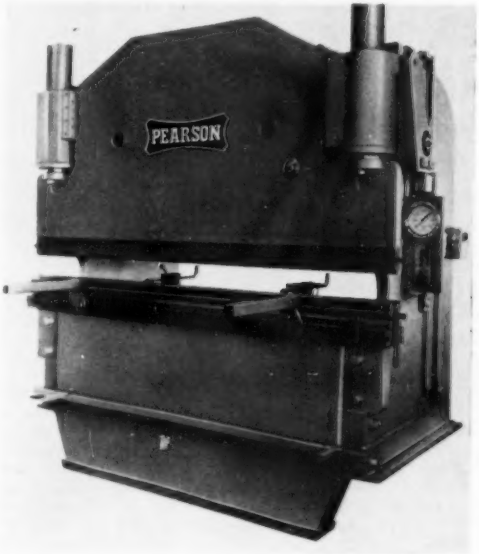
	100 Tons	50 Tons
Gap from centre-line of dishing tool to back of Throat	4 ft.	4 ft.
Maximum stroke of pneumatic cylinder	9 in.	9 in.
Overall length	9 ft.	8 ft.
Overall height	8 ft.	6 ft. 9 in.
Overall width	3 ft. 1 in.	2 ft. 9 in.

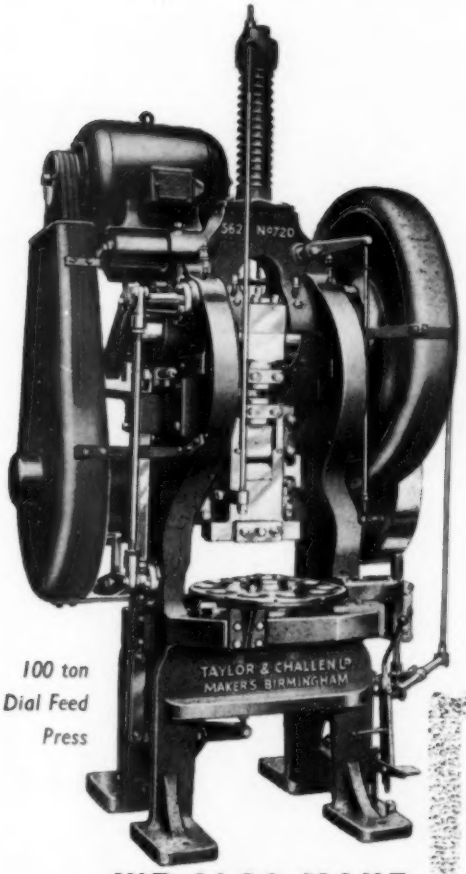
Electro-Hydraulic Flanging Presses

THE Pearson Machine Tool Co. Ltd. of Walker, Newcastle-upon-Tyne, 6, have produced an improved range of electro-hydraulic flanging presses from 50 tons capacity upwards, which are claimed to embody all the tried features of the existing range but with innovations of considerable advantage to the user. Power return of the ram is effected by reversing the main hydraulic flow, thus giving a more positive action and greater return speed; this is particularly useful when the press is used for punching work in withdrawal of the dies. Hydraulic stroking is longer, size for size, than in the previous range of machines and up-stroke and down-stroke variations are offered over the whole length of hydraulic stroke. Another new feature is the incorporation of a magnetic clutch between motor and pump so that the multi-cylinder radial pump only runs when the press is actually stroking, thus minimizing wear. Fig. 11 shows a 200-ton press in this range.

(*Continued in page* 636)

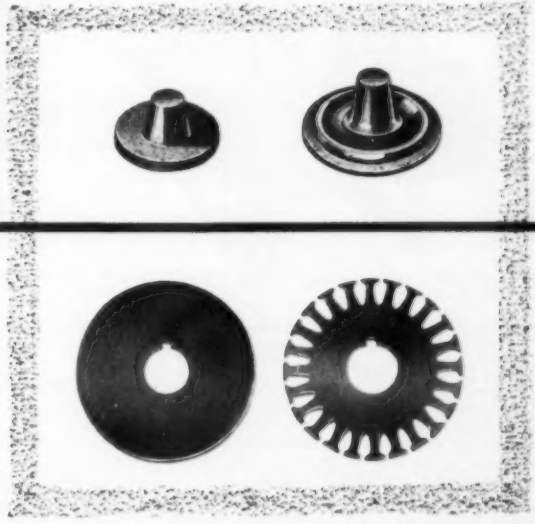
Fig. 11.—Electro-hydraulic flanging press





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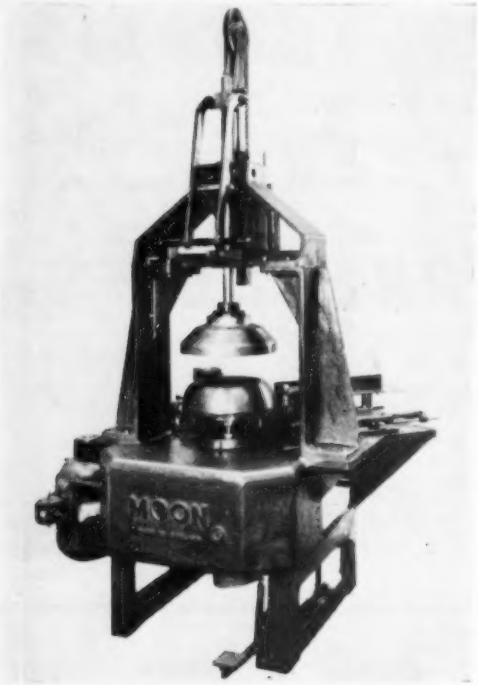
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Semi-automatic Trimmer and Beader

MOON BROS. of Birkenhead have designed and manufactured a semi-automatic trimmer and beader for the production of large-diameter metal pressings, Fig. 12. The machine will handle a range of sizes from 12 in. to 28 in. and is speedy in operation, the time required for one complete cycle being 3.2 or 6 seconds; there is an automatic clutch for starting and stopping and two independent cam-controlled tool posts enable all combinations of flange-trimming, curling and beading, rilling and flanging, as well as double seaming to be performed. The overall size is 53 in. by 70 in. wide and 99 in. high, and a 5-h.p. motor is used operating at 960 r.p.m. or 200 r.p.m.

Fig. 12.—*Semi-automatic trimmer and beader*



100-Ton Capacity Downstroking Hydraulic Operating Press

FIG. 13 shows the "Barnes" 100-ton capacity downstroking hydraulic operating press shown by George Cohen, Sons and Co. Ltd. at the International Machine Tool Exhibition. The machine has an operating pressure of 3,000 lb. per sq. in., is universal in application and any thickness of material, within the rated capacity of 100 tons, may be worked without re-setting.

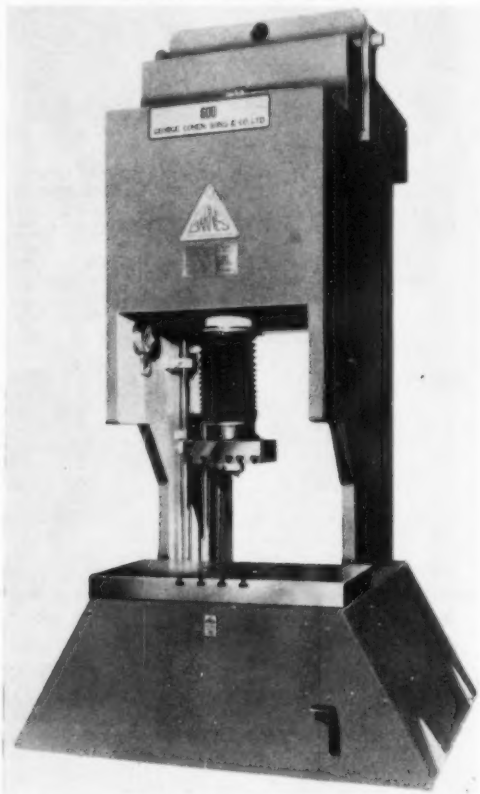
The bed area of the machine is 54 in. × 26 in., overall height 8 ft. 9 in., depth from front to back 6 ft. 6 in. and overall width 4 ft. 6 in. The height to the top of the bolster from ground level is 34½ in.

The 4-in. thick bolster is equipped with diagonal tee slots and the centre hole, 7 in. in diameter, is fitted with a removable ring. The maximum admission width between side plates is 36 in. but when equipped with the optional automatic stroking device the maximum width which can be passed through the back is restricted to 32½ in.

With a down ram speed of 35 in. per min. and an up ram speed of 50 in. per min., the independent pressure control valves that are available on approach and return strokes enable a pre-determined stripping pressure to be used if so desired. The automatic stroking device enables single or repeat stroking to be selected at will, the stroking being variable from a minimum of 1½ in. to a maximum of 12 in. Short strokes can be selected to operate at any given point between the above maximum and minimum.

The built-in hydraulic pump unit is of the mono-radial type, by Andrew Fraser, and is driven by a 7½-h.p. motor suitable for 400-440/3/50 supply and running at 960 r.p.m. A large filter is fitted, and the maximum oil reservoir capacity is 75 gallons.

Fig. 13.—100-*ton hydraulic press*



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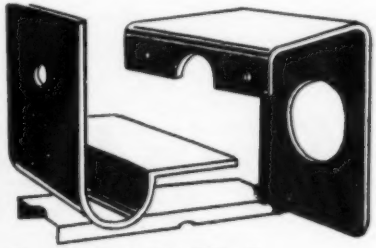


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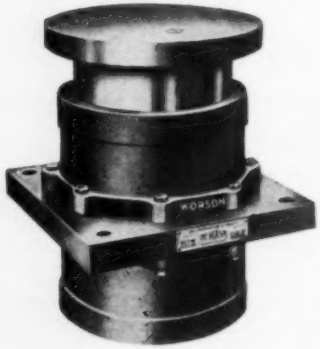
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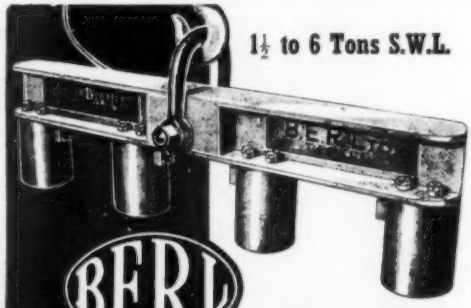
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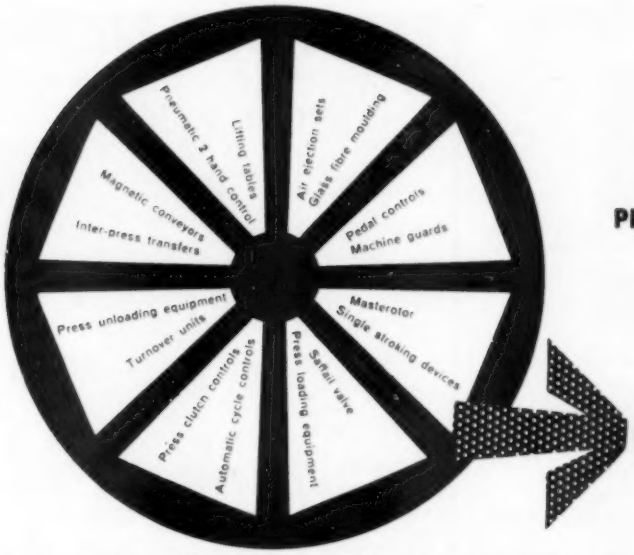
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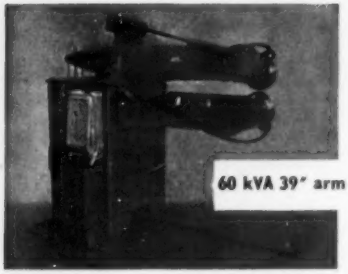
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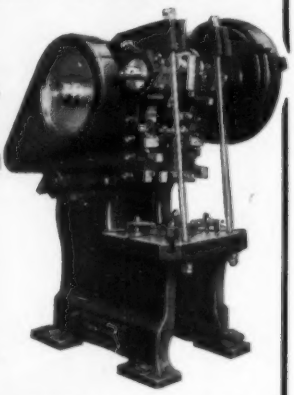
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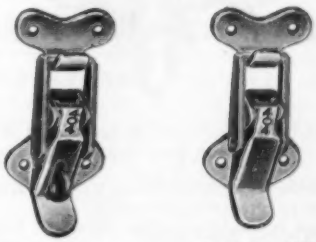
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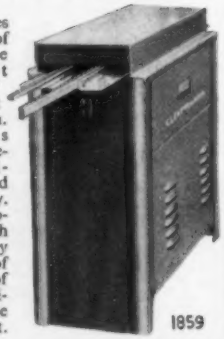
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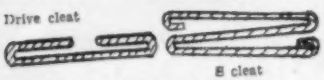
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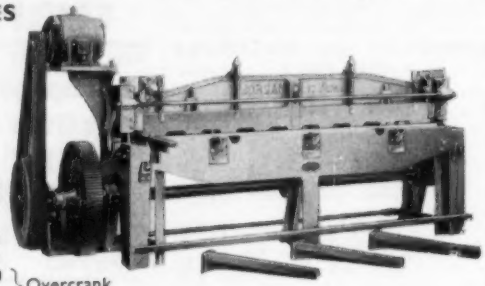
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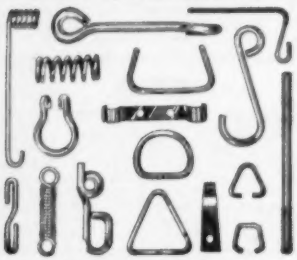
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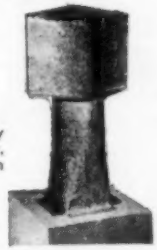
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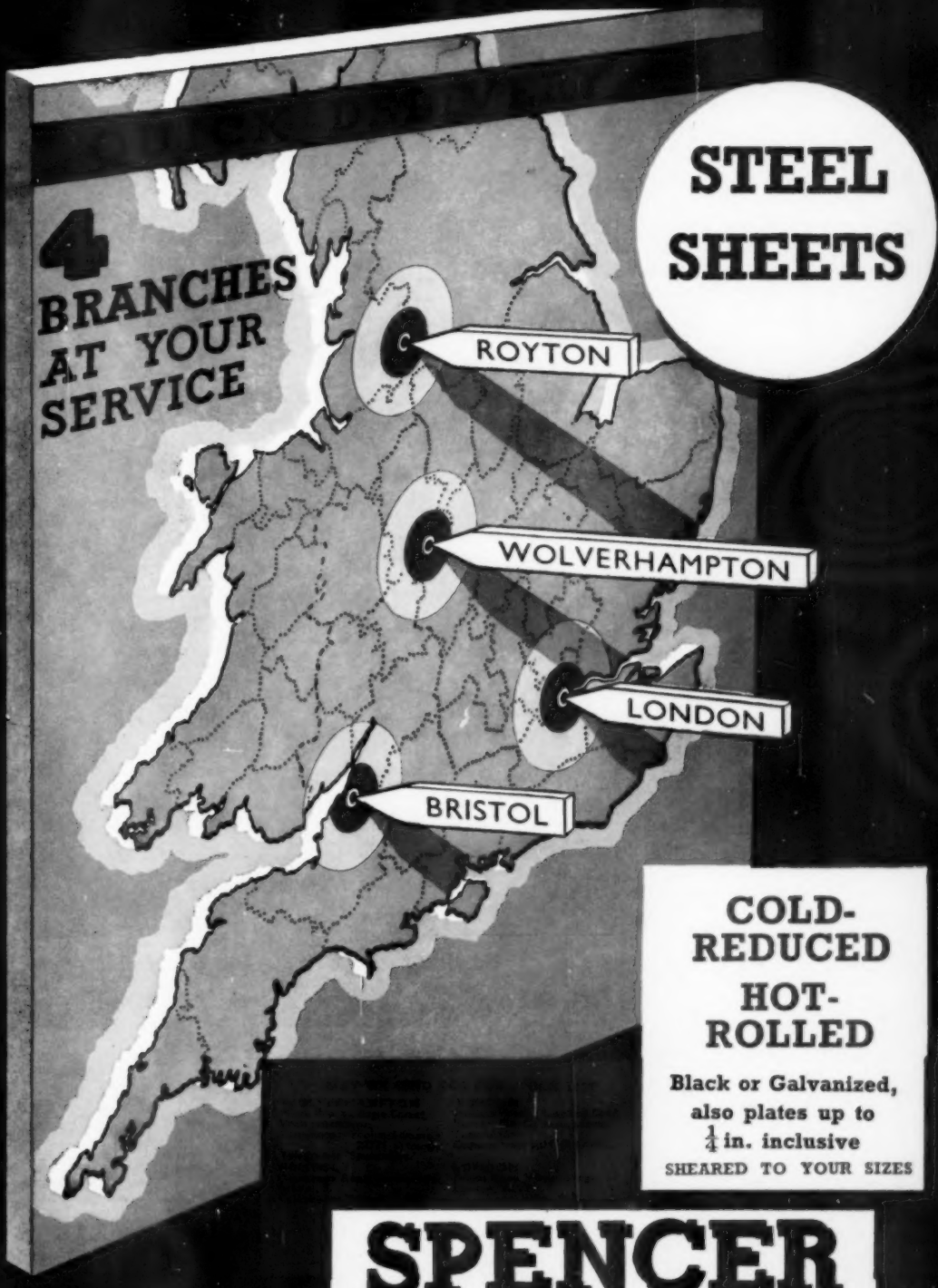
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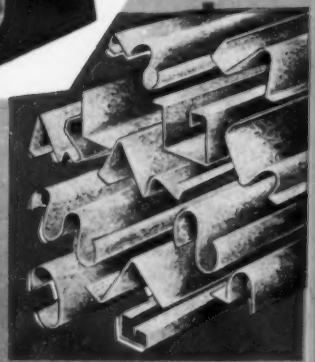
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